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THE VALUE OF RADIOLOGY IN THE DIAGNOSIS OF PERFORATED PEPTIC ULCER[1]

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THE potential value of the X-ray as an aid in the diagnosis of perforated peptic ulcer was first suggested in August of 1915 by Popper in a paper dealing with radiological observations in cases of gastro-intestinal perforation. Four years before the appearance of this paper, Popper observed a patient with symptoms interpreted clinically as those of an acute perforative peritonitis with spontaneous recovery. X-ray examination with a barium meal undertaken 8 days after the onset of the abdominal pain showed pyloric deformity and stenosis with hepatofixation. Between the right diaphragm and the upper surface of the liver there was noted during fluoroscopy a sickle-shaped zone of radiolucence which was interpreted as air escaped through a perforated peptic ulcer. Popper noted that such a spontaneous pneumoperitoneum can hardly be confounded with any other condition, that its presence or absence can be established with relative ease, and that it occurs following perforation of gastric, duodenal, and intestinal ulcers and also occasionally in perforative appendicitis and after injuries to the intestines.

Earlier in the same year (April, 1915) Wieland observed a case of perforated ulcer with a crescentic, transparent zone between the liver and the right cupola of the diaphragm. This radiolucent zone disappeared when the patient was changed from the upright to the recumbent position. At laparotomy undertaken some time later a duodenal ulcer was found agglutinated firmly to the pancreas. There was also periduodenitis with abscess formation and interposition of a portion of the transverse colon between the upper surface of the liver and the right leaf of the diaphragm. A subsequent necropsy confirmed these observations. Wieland concluded that the duodenal ulcer led to perforative peritonitis with agglutination and fixation of the proximal segment of the transverse colon in the right subphrenic space. In consequence of this autopsy observation, the air seen on fluoroscopy was interpreted not as lying free in the peritoneum but in the colon, with also a downward displacement of the liver similar to the hepatoptosis described earlier by Chilaiditi. In 1916, Lenk, a military surgeon reporting on the X-ray observations of abdominal gunshot wounds, emphasized the significance of intraperitoneal free air in these conditions. He suggested that in civil practice radiological examination for pneumo-peritoneum would be of value in differentiating a perforated peptic ulcer from a ruptured appendix or gall bladder.

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In recent years the literature dealing with the diagnosis of perforated peptic ulcer has become enormous, yet relatively few reports on spontaneous pneumoperitoneum as an early[1] diagnostic aid in perforated peptic ulcer have been published. Single cases are reported by Weil (1916), Martin (1917), Bager, Estes (1920), Kellogg (1921), Dahm (1922), Wessler and Jaches (1923), MacCharles (1925), Ayerza et al (1927), and Friend (1928). The number of series of cases reported is likewise limited. Schottmueller in 1921 described 3 cases of acute perforated ulcer in 2 of which free peritoneal air was demonstrated. In the third the author, in order to explain the absence of a pneumoperitoneum, assumed rupture to have occurred into the omental bursa. At the annual meeting of the Missouri Valley Medical Association, June, 1922, Vaughan read a paper on "The Value of Radiology in Acute Surgical Abdomen" in which he cited and demonstrated X-ray films in a few cases of perforated peptic ulcer with spontaneous pneumoperitoneum. Five cases were reported by Copher in 1924, in one of which the cause of the perforative peritonitis was not established. In the same year Vaughan and Brams (24) published data on 15 cases of anatomically proved perforated ulcer in 13 of which free air was present. In 1925, Guillemin recorded 7 cases of spontaneous pneumoperitoneum, 4 of which were due to perforated ulcer. Vaughan and Brams (25) in a second report which was published also in 1925 added 14 more observations to their previous cases raising the number to 29. In a paper which appeared in 1927, Cottle and Spaulding discussed the value of the X-ray based upon a study of four cases in which perforation occurred aboard ship. In 1928, Utili and Pasquier each described two cases. The following review includes 29 previously reported and 43 additional cases, making a total of 72 patients with perforated ulcer examined radiologically, primarily for the presence of intraperitoneal free air.

Our first resort to the X-ray as an aid in the diagnosis of acute perforation of the stomach or duodenum occurred as follows:

A man 56 years of age, while being examined by one of us (H.A.S.) on November 22, 1921, developed sudden symptoms of perforative peritonitis. The history of antecedent ulcer distress, typical in all respects, had already been obtained and the diagnosis of a perforated peptic ulcer seemed highly probable. A surgeon (R.T.V.) was called. A non-reducible, tender, epigastric epiplocele led to a discussion at the bedside regarding the possibility of a strangulated linea alba hernia as the cause of the patient's symptoms. When asked to sign the formal operative permit the patient, who had listened to the discussion, demanded further proof of the correctness of the diagnosis before submitting himself to a laparotomy. It occurred to one of us (R.T.V.) to look with the fluoroscope for the presence of a pneumoperitoneum. A large, freely movable peritoneal gas bubble was demonstrated, the patient's consent to operation finally obtained, and the ulcer perforation found and sutured.

Throughout the course of our work with abdominal emergencies we have been continually more impressed as to the value of this method as an aid in diagnosis and feel that its limited use by surgeons up to the present time is due mainly, if not entirely, to lack of knowledge of its worth. All those surgeons and others who have actually used the X-ray for this purpose recommend it highly. The objections which various clinicians have offered to this method of examination of the "acute abdomen" indicate a lack of acquaintance with radiology or a limited experience with acute abdominal conditions, or both. For instance, it has been alleged that X-ray examination adds unnecessary manipulation. That is not the case with our X-ray technique which has been described elsewhere (see Vaughan and Brams, 24, 25). We repeat that usually the patient is merely passed before the upright fluoroscope while lying on the hospital cart en route to the operating room. Diagnostic consultations are frequently held in the X-ray department instead of in the ward or operating room. Usually we observe the patient fluoroscopically in the left lateral as well as in the supine position. Fluid levels and demilunes of peritoneal exudate, if present, gas patterns in the bowel, and diaphragm movements are also noted. The left lateral position is favored since it permits the gastric air bubble to occupy the juxtapyloric area in which over 90 per cent of free ulcer perforations occur, and the left lateral

[1]Reports dealing with the gas-containing subphrenic abscess which occurs later as a complication are not included. The so-called "subphrenic pyopneumothorax" was demonstrated radiologically as far back as 1901 (see Weinberger).

position also tends to prevent further leakage of gastric liquid contents while air is permitted to escape instead. The amount of manipulation required is trifling compared with the manipulation involved in physical examination by the careful surgeon, who may require several changes of position including the sitting posture in order to enable him to percuss, palpate, and auscultate the patient's chest and abdomen. This complete physical examination is essential to the accurate diagnosis of acute abdominal conditions and we never omit it. X-ray examination is equally essential.

Another objection occasionally interposed is that valuable time is consumed in the X-ray examination. This objection is not valid in good modern hospitals which possess average X-ray equipment. Five minutes is more than sufficient for a complete fluoroscopic examination, less time than it requires to do a white blood count. Nor need the X-ray examination cause even a moment's delay when "acute surgical abdomen" already has been diagnosed, for fluoroscopy is then performed while the operating room is being "set-up." The taking and developing of films is unnecessary for diagnosis since fluoroscopy gives all the needed information; however, films are useful for purposes of record when sufficient time is available. Delays of deliberation and consultation on the other hand, cost not minutes but hours when the X-ray might give an immediate decision. A colleague, who "feels that the X-ray is not practical," requested in a case of perforated ulcer an hourly blood count "in order to determine the presence or absence of a perforative peritonitis." The fluoroscope settled the problem at a glance.

Some surgeons and internists offer no objection to radiographic examination but state that they "do not need it" for diagnosis. These are clinicians who have seen only a case or two or have merely a textbook knowledge of perforated ulcer. It is, in fact, as impossible to make a correct diagnosis in every case of a long series of cases of perforated peptic ulcer as it is in a long series of cases of acute appendicitis. No clinician of the present day is able to make an invariably correct diagnosis in all cases of acute abdominal conditions previous to laparotomy. The most competent surgical opinion for many years has been that exploratory laparotomy is necessary to complete the diagnosis in a substantial proportion of these cases. The correctness of that dictum still holds and perforated peptic ulcer is no exception. All clinical data available, including the X-ray, are sometimes insufficient to complete the diagnosis in atypical cases. For instance, even Moynihan in 49 cases which turned out to be perforated peptic ulcer made a right lower quadrant appendiceal incision in 18 cases; and Moynihan generally and rightly is considered an abdominal diagnostician of first rank. W. J. Mayo writes: "In nearly all of our earliest operations for acute perforations of the duodenum a negative exploration of the appendix was first made and the perforation of the duodenum was found during further exploration." It is by no means unheard of for a surgeon to diagnose appendicitis and remove the appendix in such a case and discover the ruptured ulcer subsequently at autopsy. We know a few instances in which this has happened to university professors of surgery. It follows, therefore, that their students as well as they themselves cannot afford to dispense with any possible clinical adjuvant in the diagnosis of perforated ulcer or in other cases of "acute surgical abdomen." The last of these statements will be denied only by those surgeons who are beginning their experience with acute abdominal conditions or who do not have routine autopsy checks in their fatal cases.

In our present series 72 cases with a final diagnosis of perforated peptic ulcer were examined with the X-ray shortly after admission. Nine patients in whom free intraperitoneal gas was absent recovered spontaneously without operation. Omitting these 9 because definite proof of a perforated ulcer is lacking there remain 63. In 54 of these 63 cases evidence of a pneumoperitoneum was found. In 49 of the patients with free intraperitoneal gas, the presence of a perforated peptic ulcer was proved by operation or autopsy. The other 5 patients recovered spontaneously without operation, but subsequent clinical and X-ray examinations demonstrated the presence of peptic ulcer in all 5

Fig. 1. Spontaneous pneumoperitoneum from perforated peptic ulcer of 24 hours' duration. Operative closure with gastro-enterostomy. Death from empyema.

with no other source for the spontaneous pneumoperitoneum. We feel justified in including them in our series as reasonably definite cases of perforated peptic ulcer. Of the 18 patients diagnosed perforated ulcer, in whom we were unable to demonstrate the presence of a gas bubble on admission to the hospital or subsequently, the diagnosis was corroborated by operation in 9. The other 9 patients recovered without laparotomy and, since both roentgenographic and anatomical proof of perforation is lacking, the diagnosis scarcely can be looked upon as absolutely established although the clinical evidence has led us to consider perforated ulcer the most likely diagnosis.

If one includes in the statistics only the cases in which the diagnosis is not open to question, 54 of 63 examined radiologically, or 85.7 per cent, presented evidence of free gas. It is a striking fact that the percentage of positive cases has remained almost constant throughout the entire period of our observations. Of the first 15 cases in the series reported in 1924, 86.7 per cent revealed a pneumoperitoneum and of the 29 cases reported the following year the percentage was 86.2. Any diagnostic measure which furnishes a positive result in approximately 85 out of every 100 cases must be considered to have substantial value.[1] We know of no single symptom or sign in perforated peptic ulcer which is so constant or so free from possible misinterpretation as spontaneous pneumoperitoneum!

If, on the other hand, the statistical figures include *all* our cases diagnosed perforated peptic ulcer, irrespective of whether or not they were proved by operation, the percentage showing pneumoperitoneum is decreased to 75. The 9 *less* definitely proved cases which are the source of this lowered percentage can be readily segregated from the remainder of the series by their relatively mild symptoms. They represent what may be termed "abortive" cases, since, although their onset may be sudden and stormy, a remarkable improvement quickly sets in with early disappearance of serious symptoms. They are cases of spontaneous closure of the perforation with only a trifling leakage. Usually these perforations are small—even pin-point. The clinical characteristics and pathological anatomy of this group have been discussed elsewhere by one of us (H.A.S., 22) but without reference to the X-ray. It is only since we have learned to recognize the clinical picture of spontaneous closure of acute perforations that we have added to our statistics a group of cases which hitherto have not been looked upon as perforated ulcers at all and, therefore, not subjected to roentgen examination. Such cases are likely to be diagnosed acute cholecystitis, acute pancreatic disease, diaphragmatic pleurisy, alcoholic gastritis or colics of some type, and the like.

When in doubt as to whether or not a patient with negative X-ray findings and mild and atypical symptoms too slight and indefinite to justify surgical exploration, even if

[1] Since completion of this manuscript a report on X-ray observations in 24 cases diagnosed perforated ulcer has appeared (Kudlek, F. Zur Diagnose des durchgebrochenen Magenschwuers. Zentralbl f. Chir., 1929, lvi, 1293-1298). Spontaneous pneumoperitoneum was found in 20, or 83.3 per cent, of the patients examined. In 2 of the 4 cases in which free air was absent the diagnosis of the perforation was based on clinical data alone. If, therefore, only the definitely established cases of perforation are included, the percentage of cases with demonstrable pneumoperitoneum rises to 90.9.

the patient would consent, may have a leaking ulcer, we adopt the following procedure: The patient is left on the hospital cart or put back to bed to lie on his left side for one or more hours in order to allow the air within the stomach to rise to the pyloric region and duodenum (where over 90 per cent of the free perforations are located) and escape if it will. The patient is examined physically and radiologically at intervals. If air is present in the stomach and the perforation is still patent and not walled-off, soon a few bubbles of air will leak out and appear at the uppermost point of the peritoneal cavity, i.e., between the liver and the right abdominal wall, when the patient is lying on his left side. When pneumoperitoneum is absent we often sit up the patient to examine the heart, lungs, mediastinum, and diaphragm. We have no fear of sitting up a patient momentarily who has perforative peritonitis whenever anything of value is likely to be derived from either physical or radiological examination in this position. Perforative peritonitis is diffuse in any event and the pelvic peritoneum withstands infection better than any of the upper abdominal portions. Any free fluid found at operation in the abdomen, flanks, or in the pelvis is removed by suction because the peritoneum recovers more easily and promptly when dry.

Why free gas is not present in some perforations. The postural procedure described above, viz., placing the patient on the left side, is based upon the natural presumption that air, if present in the stomach, must be brought in contact with the perforation in order to escape through it into the peritoneal cavity. Accordingly, if a patient with a perforated ulcer assumes and maintains the right lateral position, which is the least favorable for the escape of air, little or no gas will find its way into the peritoneal cavity. A less frequent reason for the failure of free air to accumulate in the peritoneal cavity following perforation is the absence of gas in the stomach at the time of rupture. In this event simultaneous absence of air in the peritoneum does not possess the same negative diagnostic value as when the usual gastric air bubble is present. A third and perhaps the most frequent cause for the failure of pneumoperitoneum to develop is that the perforation is so tiny or becomes stopped up so quickly that too little air leaks out to be visualized; or none leaks out at all. A fourth possibility to account for the absence of a shifting peritoneal air bubble is demonstrated by two of our cases in each of which at laparotomy the gas was found closely circumscribed by perigastric adhesions. The encysted gas was evacuated at operation in both cases.

Fig. 2. Same case as Figure 1. Left lateral position.

Spontaneous pneumoperitoneum from other causes. It should be borne in mind, as pointed out by Popper in his original article on the subject, that spontaneous pneumoperitoneum occurs in conditions other than perforated peptic ulcer. Free intraperitoneal air was found radiologically by Kenéz, following acute perforation of a tuberculous ulcer of the appendix. Two cases of suppurative and perforative appendicitis producing pneumoperitoneum were reported by Guillemin. Dandy recorded a case of typhoid perforation which was recognized with the aid of the X-ray. Bager described a case in which a carcinoma of the stomach was resected and due to a leak in the suture line a pneumoperitoneum resulted. Pneumoperitoneum following gunshot wounds was described by Lenk in military service and by Guillemin in civil practice. A unique case of artificial pneumoperitoneum was cited by Dunham, in which a metal catheter, used for the purpose of inducing

abortion, penetrated the peritoneal cavity and permitted air to enter.

During the course of our study of acute abdominal conditions, we have discovered several cases of pneumoperitoneum following blunt trauma to the abdominal wall as well as gunshot and stab wounds. Aside from these traumatic cases we have encountered 9 instances of spontaneous pneumoperitoneum not due to peptic ulcers. In 2 cases the gas was caused by perforated carcinoma of the stomach, in 3 by perforative appendicitis, in 2 by perforation of a tuberculous ulcer of the small intestine, and in 2 by rupture of a typhoid ulcer. Fortunately, the history and the associated clinical data rendered the diagnosis clear in all but 2 cases, viz., a perforated gastric carcinoma and a ruptured appendix.

The fact that spontaneous pneumoperitoneum is found in abdominal conditions other than perforated peptic ulcer constitutes no practical objection to its diagnostic value. Almost without exception every acute abdominal condition with a "free gas bubble" is a case of perforative peritonitis from rupture of a gas-containing viscus. Unless the peritonitis is relatively trifling in degree and extent, surgical exploration is required in any event. The most serious error which may occur under these circumstances is the possible choice of an unfavorable site for the laparotomy incision. We are inclined to believe, however, that if X-ray examination is properly used to supplement the usual history and clinical examination, few mistakes in the placing of incisions will occur in cases of perforated peptic ulcer.

SUMMARY

Seventy-two patients diagnosed perforated ulcer were examined radiologically for pneumoperitoneum at the time of admission to the hospital. In 63 of the 72 patients the diagnosis of a perforated ulcer was definitely established. Of these 63, 54 or 85.7 per cent had free intraperitoneal air as determined fluoroscopically. In the 9 remaining patients the evidence of perforated ulcer was not conclusive inasmuch as pneumoperitoneum was absent, laparotomy was not performed, and autopsy was precluded by recovery.

The clinical picture in the 9 unproved cases corresponds to that seen in perforations which become spontaneously sealed following the escape of a limited amount of gastric or duodenal content. The reason for the lesser frequency of pneumoperitoneum in these *formes frustes* cases is probably the same which explains the mildness of the course, viz., a small leak and a trifling leakage.

During the period in which these perforated ulcer cases were observed, spontaneous pneumoperitoneum due to other causes (exclusive of trauma) was encountered nine times. In all but 2 of the 9 cases the correct diagnosis as to the cause of perforation was rendered clear by the history and clinical observations.

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DISLOCATION OF THE TESTIS

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AN ectopic testis is by no means a rare occurrence; in truth, it is rather common. Cryptorchidism (abdominal, suprainguinal, inguinal, and subinguinal) has been found to occur in from 0.1 to 0.2 per cent of all young adults. In the vast majority of cases it is a congenital condition due to defective development; either an abnormal mesorchium, a vicious insertion of the gubernaculum testis, a narrowness of the external inguinal rings, a shortness of the cord or vas and adhesions binding these structures, or a rudimentary development of the scrotum. On the other hand, aberrant migration of the testis is rather uncommon and is far rarer than a simple cryptorchidism. Many cases are reported in which the testis, before or immediately after birth, has migrated to various regions out of its normal course of descent. These represent the various types of congenital ectopic testis: pelvic, femoral, crural, penile, pubic, and perineal. With the exception of the congenital perineal testis, these varieties are not common. Of the perineal type, however, Weinberger has collected 74 and Klein 81 cases. There is one other congenital anomaly of the descended testis of which there are 13 cases reported in the literature, the so-called transverse ectopic testis. In this abnormality the testis comes out of one external inguinal ring and then crosses to lie in the scrotum on the opposite side. These various congenital anatomical anomalies of cryptorchidism and aberrant migration of the testis are all present at the time of, or occur shortly after, birth.

In this paper, we are not primarily concerned with the congenital ectopic testis but rather with traumatic dislocation of the normally descended testis. This condition is indeed far less common. We have searched the literature very carefully from the year 1800 to the present time. In this period we find reports of 30 cases of traumatic dislocation of the testis. Six of these are repetitions and one, though called traumatic, is really a congenital ectopy. There are, therefore, reports in the literature of only 23 original cases of traumatic luxation of the testis. All of these original articles have been studied carefully and will be reported here in detail.

Before presenting these cases, let us consider the various anatomical possibilities for the dislocation of a testis when forcibly extruded from the scrotum. We believe that its resultant position is dependent upon three factors: (1) anatomical abnormalities, (2) obstruction, present or superimposed, at the scrotal neck or in the inguinal or perineal region; but for the greater part (3) on the direction and force of the blow. In the normal individual the external inguinal ring hugs the cord snugly. Unless it is markedly relaxed or the testis itself very atrophic, the testis could not be forced up through the external ring into the inguinal canal. If the external ring is considered as the hub, it is possible after the expulsion of the testis from the scrotum to have it dislocate into any position on the circumference of the wheel, depending on the direction and force of the blow and obstruction along its path. All these migrations would be entirely subcutaneous and would give rise to positions similar to those of the congenital ectopic testis.

The accompanying diagram (Fig. 1) shows the various possible positions of the dislocated testis. On the patient's right side, it is shown in the positions it might occupy if it were extruded from the scrotum but did not pass through the external inguinal ring into the canal. In this group of subcutaneous dislocations, we find the superficial inguinal, the superficial abdominal or pubic, the penile, the crural, and the perineal (shown in Fig. 1, a); while on the left side we have shown the various possibilities if the testis passes through the external inguinal ring and into the inguinal canal. It may then be found in the inguinal or femoral canals or intra-abdominal.

It was most interesting, after having theorized as to these various possible dislocations, to search the literature and find actual case reports of almost every type. We can find no records of a traumatic intra-abdominal or femoral testis and, except for our new case reported here, no authentic case of a crural testis in the literature as far back as 1809. All other types are found to be represented. The pubic and superficial inguinal types are, as one would expect, the most common, with 6 and 5 cases, respectively. There are 3 of the penile and 2 of the perineal types, 3 in the inguinal canal, 3 of traumatic herniation or compound dislocation of the testis through the scrotal wall, and 1 case in which it is impossible to place the dislocation accurately. We herewith add to this list one of the crural type and one compound dislocation of the testis.

The etiological factor in all these cases was trauma. It is interesting to find that of the 23 cases, 9 were the result of wagon wheels rolling over the genital and inguinal regions. In the remaining 14 cases various accidents occurred, all of which were very severe and resulted in the crushing of the scrotum. The symptoms presented in most cases were immediate severe shock with nausea, vomiting, and great local pain. In one case (Donovan and Ortiz) there was also marked epigastric discomfort. Examination immediately after the trauma often does not disclose the luxation, because of the acute swelling, hæmorrhage, and pain, but in a few days, when the acute reactions have subsided, one is able to note the absence of the testis from the scrotum and also to discover an ovoid tumor in a foreign locality. Pressure on this mass causes the peculiar testicular sensations and pain which are usually readily volunteered by the patient. Naturally, either an open or closed reduction must be carried out. It is rather astonishing to find that in only 4 cases was the testis restored to the scrotum without an open operation. Six patients were not treated at all, and 13 required an open reduction. All except 1 of the patients were cured, but in this one, it was impossible to keep the testis in the scrotum and an orchidectomy was necessary. It is also interesting to note that in only 2 cases was the epididymis torn loose from the testis. In all the rest, except one in which this factor could be determined, the tunica vaginalis was intact and the epididymis uninjured. One can, therefore, conclude that in traumatic dislocation of the testis, the diagnosis and treatment are rather easy and the ultimate results excellent.

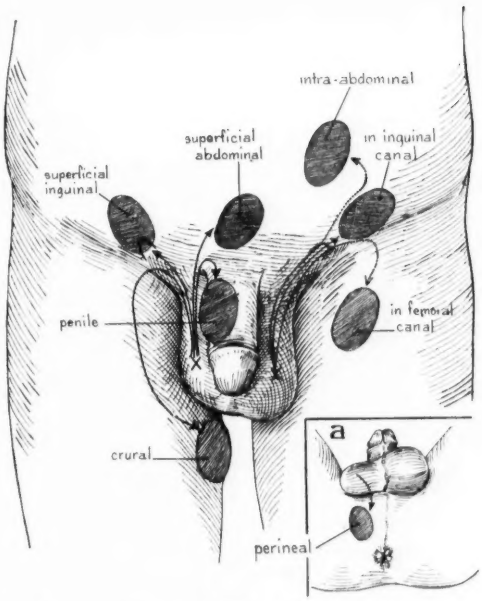

Fig. 1. Diagram showing the various possible positions in which a dislocated testis may locate. (1) Patient's right testis not passing into the inguinal canal affords the 5 subcutaneous dislocations—pubic, superficial inguinal, penile, crural, and perineal (in insert, a). (2) Patient's left testis has passed through the inguinal canal. This affords the possible true inguinal, abdominal, and femoral testis.

Let us now consider the different anatomical varieties of dislocation of the testis. There are three types: (1) The internal dislocation group—that in which the testis is forced through the external inguinal ring, with the resultant inguinal canal, abdominal or femoral testis. (2) The superficial dislocation group—that in which it does not pass through the external ring, but is forced subcutaneously into any position on the circumference of a circle with the external inguinal ring as the center. In this group we have the superficial inguinal, superficial abdominal or pubic, penile and crural types. (3) Compound dis-

Fig. 2. Photograph of Popow's case, Paris, 1888. Shows a dislocation of the right testis to the pubic region. No history. Not treated.

location—that in which there is a true herniation of the testis through the scrotal wall.

We will discuss each type and group of these dislocations and then present brief histories of all the cases of dislocation of the testis which we have found in the literature and two cases which we had this year in the Department of Urology of the Johns Hopkins Hospital. These cases have been grouped in accordance with their anatomical location.

INTERNAL DISLOCATION OF TESTIS—THREE CASES

It has already been stated that in order that the testis may pass back through the external inguinal ring, there must be some anatomical abnormality. Either there is an atrophic testis, a relaxed external inguinal ring, or the presence of an inguinal hernia with the resultant enlargement of the external inguinal ring. It is because of the requirement of one of these abnormalities that we find very few cases belonging to this group. We have searched the literature carefully from 1800 to the present time and find only 3 cases in which the testis was dislocated by trauma into the inguinal canal. The one reported by Nicolas in 1899 is a repetition of Lee's case. Lee, in 1869, in St. George's Hospital reports in London, referred to a case of "Disappearance of One Testicle." This is simply a brief paragraph stating that a young man, who had been wearing a truss for a left inguinal hernia, came to him because his left testis had disappeared. Although it could not definitely be felt in the inguinal canal, it was presumed that it had been forced there by the pressure of the truss. He was advised to stop wearing it and in a few days the testis reappeared in the scrotum. It is, of course, possible that this was a true abdominal testis but it would be somewhat fanciful to suppose that the testis, having been forced into the abdominal cavity, would again so quickly find its escape. It seems more likely that the testis was in the inguinal canal near the internal ring and not palpable. The two other cases were reported by J. A. Hawkins in 1914. One was the result of a trolley injury and the other of a locomotive accident. In each case diagnosis was simple as one was able to feel the gland in the canal. Open reduction was necessary and the ultimate result excellent in each case. No history is given as to how the testis got through the external inguinal ring in one case and perhaps this should be really classified as a superficial inguinal case. In the other instance, mention is made of the tearing of the structures of the external ring. This, no doubt, allowed the dislocation into the canal. Bruns, in 1883, stated that there has been several cases of this type reported by Godard, Fischer, and LeDentu, but we have been unable to find these articles.

Case 1. Reported by H. Lee. In 1869, Dr. Cumming of Cadogan Place brought a young man to writer with the complaint that one of his testicles had disappeared. It so happened that the gentleman had a left indirect inguinal hernia for which he had been wearing a truss. The truss evidently had been worn in such a manner as to force the left testis out of the scrotum up through the external inguinal ring. The surgeon recommended that the patient should stop wearing the truss for a few days and, to his great relief, in a short time the left testicle again appeared

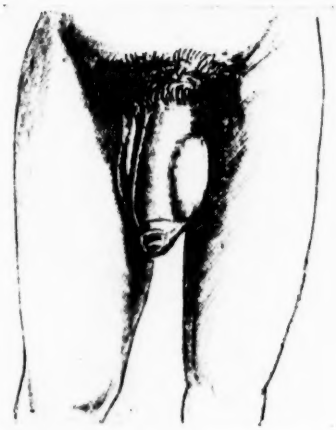

Fig. 3. Photograph of Howlett's case of penile dislocation of the testis. Shows the left testis under the skin of the shaft of the penis. Patient aged 60. Run over by wagon wheel. Not treated. (From Brit. M. J., 1890.)

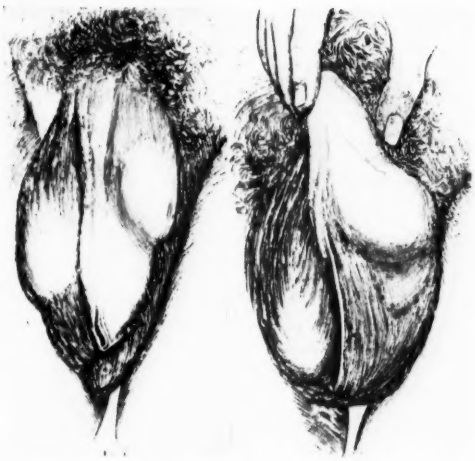

Fig. 4 (left). Guiteras' case of penile dislocation of the testis. Anterior view. Patient, aged 52, run over by a wagon wheel. Open reduction. Well. (From Med. Rec., 1898.)

Fig. 5. Photograph of the same case as in Figure 4. Penis is raised to show the swelling on left side and under surface of the penis caused by the dislocated testis.

in the scrotum. This is the only case on record where a dislocation was caused by indirect trauma.

CASE 2. Reported by J. A. Hawkins. In April, 1910, J. M., aged 24 years, was struck by a locomotive. He received severe shock and when brought to the hospital, examination showed a contusion of the hip and a puncture wound over the left inguinal region. There was a fracture of the ilium, at the left acetabulum. The left scrotum was empty. The left testis was found to be in the left inguinal canal. There was a rupture of the fibers of Poupart's ligament and a deep extraperitoneal hole leading down into the pelvis. At open operation, the testis was replaced in the scrotum and the wound drained. Recovery was complete.

CASE 3. Reported by J. A. Hawkins. In May, 1910, H. L., aged 11 years, had been struck by a trolley car and thrown against the curb. Both testes had been down in the scrotum before the accident. Examination showed a badly lacerated wound over the pubis. Only one testicle present, and absence of the penis; only the skin of the penis being present. The body of the penis was found in the wound over the pubis, its skin having been torn loose at the corona. The right testis was found in the inguinal canal. Open operation was carried out and the penis was drawn through the wound and pulled into its sheath. This was sutured as in a circumcision and the wound over the pubes drained. The inguinal canal was opened and the testis replaced into the scrotum. The result was excellent.

As to the two remaining types in this group; the abdominal and femoral, we have been unable to find a single authentic case. Claubry, in 1818, reported a case as *Observation sur une retrocession sublite des deux testicules dans l' abdomen*, but a careful review of this report leaves no doubt but that it belongs to the superficial abdominal or pubic type. He states that the testes could be easily palpated behind the pillars of the oblique muscles. If they had been intra-abdominal, this of course, would have been impossible. Congenital abdominal testes are not by any means rare, but we can find no case of traumatic abdominal testis in the literature. We are not surprised to be unable to find a case of a femoral testis. It would be most unusual for a traumatically dislocated testis to travel into the abdomen and then pass downward again through the femoral ring to lie under the cribriform fascia in the femoral canal.

THE SUPERFICIAL ABDOMINAL OR PUBIC TYPE OF DISLOCATED TESTIS—SIX CASES

The most common group of luxated testes consists of those in which the testis is dislocated subcutaneously to a position on the circumference of a circle, the center of which is the external inguinal ring. There are various types in this group, and the number of clinical cases reported in each type is given

Fig. 6. Photograph of Krausch's case. Leipzig, 1925. Shows a penile dislocation of the testis, lateral and anterior views. Patient aged 20. Auto wheel passed over scrotum and lower abdomen. Open reduction. Well.

hereinafter. The pubic and superficial inguinal types are the most common. This is as should be expected, inasmuch as a direct blow of the passage of a wheel over the scrotum and lower abdomen would force the testis up out of the scrotum and then, depending upon the direction of the force and the presence of obstruction, it would slip suprapubically or up toward the inguinal region. If it met obstruction to the inguinal path it would turn medially and travel toward the suprapubic region, becoming a pubic testis. We found 6 original authentic cases of the superficial abdominal or pubic type in the literature. The first was reported by E. C. Claubry in 1809 as a case of abdominal testis. This, however, was an error as we have already pointed out. It was evidently directly over the pubis in the midline. P. S. Conner, in 1877, reported a similar case in which the testis had been forced suprapubically and then across to the opposite side, beyond the midline. Bruns, in 1883, reported a similar case. In 1888, Popow reported a case of traumatic pubic ectopia. Figure 2 is a photograph of his case. The testis is shown at the root of the penis under the skin of the mons veneris. Popow was unable to find a similar case except that of a tailor in Moscow. We cannot, however, find any authentic report of this particular patient. Nicolas and Donovan and Ortiz each reported one case. In all these cases the age, naturally, has no significance, but it is most interesting to note that in this group, four of the six dislocations were the result of the passage of wagon wheels over the genital and inguinal regions. One was the result of a fall, and in one the accident is not described. Diagnosis of this type is easy, particularly after the acute swelling and symptoms have subsided. It so happens that in this group of 6 cases, in no one was the epididymis torn loose from the testis nor the tunica vaginalis injured. All the surgeons attempted closed reductions except Popow and Claubry who gave no treatment as their patients were not suffering from the dislocations. Conner reduced his case successfully without open operation. The reason for his success, we think, is due to the fact that he attempted the reduction on the third day after the accident. This is most important for after the testis has developed adhesions to the surrounding structures, closed reduction is out of the question. Bruns attempted a closed reduction but as it was then 4 weeks after the injury it was unsuccessful. Donovan and Ortiz and Nicolas performed open operations on their cases and with excellent results. The histories of 6 cases of this type are given briefly.

SUPERFICIAL ABDOMINAL OR PUBIC DISLOCATED TESTIS

Case 4. Reported by E. G. Claubry. The patient was a soldier 20 years old, who in May, 1809, fell from a wagon. He landed on his back and one of the wheels of the wagon passed across his scrotum and lower abdomen. He received a violent contusion of the abdominal wall and scrotum. He was cured of his contusions and 3 months later appeared in the Military Hospital. The testicles were absent from the scrotum. They were found and could be easily palpated in the suprapubic region near the internal pillars of the oblique muscles. The patient was complaining of sharp pains in the lumbar region and walking was difficult and painful. He was obliged to bend forward with his body flexed on his thighs when walking. The author was of the belief that this condition was due to the spontaneous retraction of the testes which was caused by the violent contracting of the abdominal muscles at the time of the passage of the wheel over the abdomen. This is difficult to believe; it seems far more likely that it was due to the direct force of the trauma. No treatment is mentioned.

Case 5. Reported by P. S. Conner. This patient was a teamster in the Quartermaster's Department of the U.S.A. December 17, 1861, the patient came to the Columbia Hospital, Washington, D.C. The wheels of a heavy wagon had passed over his inguinal region. He was not in severe shock. He

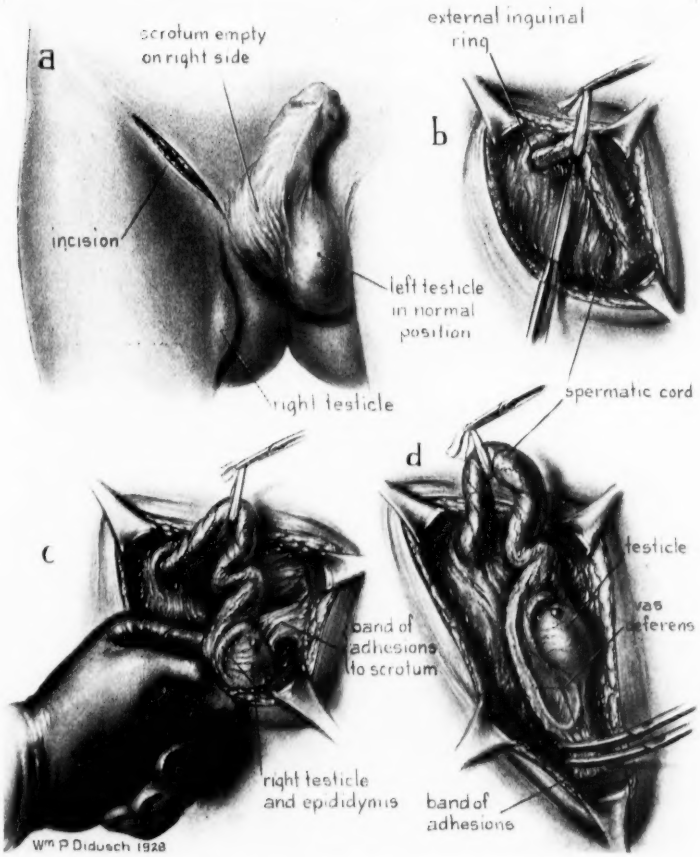

Fig. 7. Case E.D.S., B.U.I. 17804. "Writer's case" Drawings at operation. a, Left testis in scrotum. Right testis dislocated to right crural region. Right scrotum empty. b, External inguinal ring exposed. Spermatic cord coming out of ring. Separation of adhesions around the cord. c, The right testis drawn up to cruroscrotal region. Adhesions to medial subcutaneous tissues. Tunical vaginalis opened. d, Incision enlarged and retracted, showing dense adhesions in region of gubernaculum. Vas deferens shown passing far down into adhesions.

complained of severe pain in the lumbar region. Examination disclosed the fact that his right testicle was not in the scrotum. There was considerable contusion of the penis and scrotum. A little to the left of the midline directly above the pubis was a small tumor about the size of a testis. An ice cap was applied. Three days later swelling and contusion had improved so that testis could be easily palpated. On this day by digital pressure it was possible to restore the right testis to its proper place in the right scrotum. It is interesting to note here that the right testis had been forced across the midline to lie in the left suprapubic region and in spite of this marked dislocation, a closed reduction was possible, as it was done 3 days after the accident.

Case 6. Reported by P. Bruns. A well-developed man of 33 years was run over by a wagon wheel November, 1881. The wheel passed over his abdomen and scrotum. He was unable to rise and was rather severely shocked. No external wound was present but the scrotum and right side of the pelvis were markedly swollen. Examination 4 weeks later showed an old fracture of the pelvis with suppuration present. The right testis was not in the scrotum but was found under the skin of the pubis. It was of normal size and produced normal testicular sensation upon pressure. The cord could be palpated from the displaced testis to the external inguinal

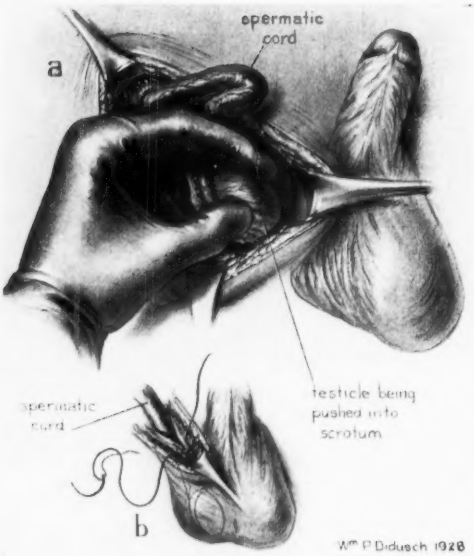

Fig. 8. Case E.D.S., B.U.I. 17804. Drawing at operation. a, Testis and cord entirely freed from adhesions and being slipped into scrotal sac. b, Three sutures placed through cremaster and dartos to draw them tightly around the cord. This retains testis in scrotum. Final location of testis in normal position.

ring. There was no separation of the epididymis from the testis. An unsuccessful attempt was made at a closed reduction. This is not surprising as it was then 4 weeks after the accident. Nothing further was done. A year and a half later the patient was again seen and conditions remained exactly as before. The patient was not complaining of any pain or discomfort from this condition.

Case 7. Reported by W. Popow. The author gives no history in this case, but presents the photographs of a dislocated testis to the pubic region. He shows the left testis to lie at the root of the penis at the lower part of the pubis. It was normal in shape and pressure caused testicular sensation. The epididymis was not separated from the testis and the spermatic cord could be traced back to the inguinal ring. The author had never seen nor heard of a similar case, but on writing to other surgeons he found one case of a tailor in Moscow who had a similar condition which was evidently the result of an injury in infancy. There is no mention of any treatment of this case.

Case 8. Reported by M. Nicolas. This patient was a man 32 years of age who fell from a heavily loaded wagon and the wheel passed over his scrotum. He lost consciousness and was taken home. Large ecchymosis of the scrotum and swelling extended to the suprapubic region which was thought to be due to hæmorrhage. He was put to bed and cold compresses were applied but pubic swelling did not entirely disappear. He was taken to the hospital where examination showed a small ovoid tumor directly over the pubis which was movable and very painful on pressure. They then noticed that the left scrotum was empty. The spermatic cord could not be found. Open reduction was done, the testis was found uninjured and directly over the pubic symphysis. It was replaced in the scrotum and the result excellent.

Case 9. Reported by R. E. Donovan and M. Contreras Ortiz. This patient was a man who suffered a fall from horseback, September 20, 1920. He immediately had very sharp pain in the left scrotal region. On trying to rise he fainted. Ice bags were applied to the region but with no improvement. He entered the hospital where he stayed for 2 months, at the end of which time he was pronounced cured. However, the patient noticed that his testis was not in the scrotum but rather in the pubic region. He was advised to have no treatment. However, on the first occasion when he rode horseback he had very severe pain in the epigastrium which was so bad he could hardly breath. There was severe nausea and vomiting. Several other attempts at riding resulted in the same discomfort. He was again taken into the hospital where examination showed the inguinal rings to be normal, the left testis was absent from the scrotum and was found to lie in the upper border of the pubis. The epididymis was felt to be normally attached to the testis. Pressure on the testis, and pulling it downward gave exactly the same experience of pain in the epigastrium of which he had previously complained. An open reduction was done, a small testis lying over the pubis was found very markedly adherent to the surrounding structures. The testis was replaced in the left scrotum and the result excellent. In this case also, since several months had elapsed between accident and operation, a closed reduction was impossible.

SUPERFICIAL INGUINAL TYPE OF DISLOCATED TESTIS—FIVE CASES

The next most common type of this subcutaneous group is the superficial inguinal. This dislocation depends mostly upon the direction of the force of the blow. The testis, not being able to pass through the external inguinal ring, slips up on top of the aponeurosis of the external oblique muscle. There are seven such cases reported in the literature, but the ones by Bruns and Nicolas are repetitions of Hess' case so that there are really only 5 authentic original cases. One each, by: Hess in 1874; Keith in 1898; Frederick in 1912; Poisson and LeRat in 1912; and Glaudea in 1922. In these we find that the passage of a wheel over the scrotum accounted for two of the dislocations. One patient was

Fig. 9. Case E.D.S., B.U.I. 17804. a, (left), On admission, testis location is shown by *X* in crural region. Testis is forced upward as far as possible, held between second and third fingers. b, Ten days after operation. On discharge right testis is seen in the scrotum.

kicked in the perineum. One was crushed between logs and the remaining one suffered from a fall. In three cases there at once resulted a swollen, tender mass in the region of the scrotum, probably the result of œdema and hæmorrhage. This subsided in a few days and then the absence of the testis was discovered. In two cases the testis was noticed at once as a small tumor in the inguinal region, a short distance above the external inguinal ring and directly under the skin and subcutaneous tissues. Pressure on this small ovoid tumor elicited characteristic testicular pain. In three cases the epididymis was not torn loose from the testis, but the testis in its tunica vaginalis along with the epididymis had been displaced *in toto* and uninjured. Poisson and Frederick make no mention of this finding, but we gather from the text that this was also the condition in their patients. Treatment in these cases was similar to that of the pubic type. Four cases were cured by operation. In one case a closed reduction was attempted, but was unsuccessful and nothing further done. Glauden's case was bilateral; one testis, he was able on the fourth day after the accident to replace and fix in the scrotum. Upon the other, he had to do an open reduction. The results in all the cases as of those in the previous type were excellent.

The following are summaries of the case histories:

Case 10. Reported by Hess. The patient is a man 31 years old who fell from a cannon August 15, 1873. The wheel of the carriage passed over his body and left leg. He had severe pain in the scrotum and felt faint. He was taken to the hospital and cold compresses were applied. Two days later examination was more satisfactory. A large ecchymosis of the left thigh extended from the knee to the groin. The scrotum was not extremely swollen. The right scrotum was empty, and there was a tumor the size of an almond in the right inguinal region, the author states 2½ centimeters from the inguinal fold. Pressure on this tumor produced testicular sensation. Three days after the accident the swelling had gone down considerably and the swelling was not nearly so tender. It was possible at this time to perform a closed reduction. Result excellent.

Case 11. Reported by A. D. Keith. On April 1, 1898, a farmer, W. Va., while training a young horse yoked to a farm cart, was suddenly thrown to the ground and the wheel of the heavy cart passed diagonally across his body from the left foot to the left anterior superior spine of the ilium. There was considerable bruising and tumefaction of the right scrotum and groin. The right testis could not be felt in the scrotum. Two days later the swelling had

Fig. 10. H. J., B. U. I. 18265. Writer's case of compound dislocation of the testis. The testis and epididymis, uninjured and surrounded by their intact tunica vaginalis, are extruded from the scrotal sac. The shaded part of the tunica vaginalis shows the scarification and superficial hæmorrhage due to trauma.

abated and one was then able to feel a small ovoid tumor over the right inguinal region, pressure upon which caused testicular pain. Closed reduction was attempted, unsuccessfully. Twenty-seven days after the injury an open reduction was done. The testis with the surrounding epididymis was found lying in its tunica vaginalis underneath the superficial fascia in the inguinal region. A nodule was found in the scrotum which proved to be an old hæmatoma. The testis with epididymis was replaced in the right scrotum and sutured to the bottom of the scrotal sac. The result was excellent.

CASE 12. Reported by Frederick (Canadian Lancet, 1912). This patient received a heavy fall to the ground which caused severe injury to the scrotum and dislocation of the testis. It was found in the inguinal region but could not be replaced in the scrotum. Open reduction was necessary and after the severance of dense adhesions it was anchored in its normal position.

CASE 13. Reported by Poisson and LeRat. A farmer, 18 years of age, presented the following history. At the age of 6 he had been kicked in the perineum and since that time had suffered periods of sickening pain in the right inguinal region. Because of these symptoms he came to the surgeon at the age of 18. Examination showed that there was only one festis in the scrotum. The other testis was located in the superficial inguinal region. Doctors previous to this time had thought that this tumor was a hernia. However, pressure on the mass produced typical testicular sensations. The parents state that previous to this injury both testes had been normally in the scrotum. An open reduction was accomplished and a normal testis was replaced in the scrotum.

CASE 14. Reported by C. L. Glaudea. The patient, J. E. W., aged 32, previous to the accident had passed army examination. While working on a log train, he got caught between 2 huge logs which compressed his abdomen and upper thighs. On admission to the hospital he was severely shocked, with weak, thready pulse of 140. Nausea and vomiting. His complaint was "I ruptured myself." The patient's face had a rather pinched expression, the abdominal muscles held rigid. The scrotum was the size of a baseball, was markedly discolored, and felt soft as if a blood clot were present. No testes were felt in the scrotum. Ovoid tumors were present in both inguinal regions and pressure on them produced testicular pain. The third day after the accident it was possible to replace the right testis into the scrotum. The left testis, however, was too adherent and 8 days later an open reduction was carried out. The testis was found lying upon the external oblique aponeurosis. There was no visible damage to the epididymis or vas and after freeing a few adhesions the testis was replaced in the scrotum. The patient is well.

PENILE TYPE OF DISLOCATED TESTIS—THREE CASES

Consider now the possibility of the testis being forced upward anteriorly out of the scrotum. When it arrives at the penoscrotal juncture it meets with obstruction so that it cannot pass either up over the inguinal region or suprapubically. It then has two possible paths open, medial or lateralward. If it passes laterally it slips under the subcutaneous tissues of the scrotum connecting that of the thigh. It would then lie in the crural region. If it passes medially it must then slip downward under the integument of the penis and belongs to the penile type.

As one would expect, we found fewer or only three original cases reported of this type of dislocation. There are 7 cases of penile luxation of the testis reported in the literature, but 3 of these are repetitions and one without doubt is a congenital ectopic testis. The case reported by J. D. in *La Presse médicale* is the same as that of Krausch, and the two reported by Nicolas in 1899 are those of Howlett and Guiteras published in 1890 and

1896 respectively. Similarly, the case reported by Lewis in the *St. Louis Clinique* is that of Guiteras. The earliest one recorded is that of E. H. Howlett in the *British Medical Journal*, of 1890. It consists of a short report with a drawing of the condition; a photograph of which is our Figure 3. The testis is shown far down along the side of the penis. From his description, the testis must have been torn from the epididymis. It is interesting that this feature is present in this and one other penile type case, that of Guiteras. In all the other dislocations, the epididymis was luxated along with the testis and not separated from it. Howlett's case was of 4 years' duration and since it afforded the patient no discomfort, no attempt at reduction was made. Guiteras published his case 6 years after Howlett. This one is recorded quite fully with two illustrations, photographs of which are Figures 4 and 5. The testis, which had been torn loose from the epididymis and ruptured through the tunica vaginalis, was lying under the dartos sheath of the penis. In 1897, Poupart reported a case, but it is without doubt not a traumatic dislocation but rather a congenital ectopic testis of the penile type. In 1925 Krausch reported another traumatic luxation of the testis. Photographs of his case are in Figure 6. These two views show the testis on the under surface of the penis. The testis was not torn loose from the epididymis. Aspiration of this tumor identified it and open reduction was accomplished. It is most interesting to note that these 3 cases were the results of very serious and terrific trauma much more so than that of the previous types of dislocation. Diagnosis also in this group is more puzzling and often is not evident for several days. The symptoms were not so marked nor peculiar except for the fact that these patients did not have any erections, due to the presence of the gland in the penis causing pain when erection began. All these cases were caused by wheels passing over the genital region. Open reduction was necessitated in two cases and the results obtained were excellent. The remaining case was not treated.

Brief histories of the cases of the penile type of dislocation follow:

CASE 15. Reported by E. H. Howlett. The patient, W. C., aged 65 years, laborer, came to the author in 1886. He had been knocked off a wagon, the wheels of which had passed obliquely over the left side of abdomen and scrotum. In addition to the spinal symptoms for which he came for treatment, it was noted that the left testis was absent from the scrotum. It was found to be lying on the left side of the body of the penis directly under the integument. The epididymis could be felt near the external inguinal ring. It had evidently been torn loose from the body of the testis at the time of the accident, but was still connected to it by the vas. The testis seemed normal in size and consistency and pressure gave the usual testicular sensations. The patient was not inconvenienced particularly by this dislocation. It had been four years since the accident, and during this time he had had no erections. This patient was not treated. This and one other penile dislocation are the only cases in which the epididymis was torn loose from the testis.

CASE 16. Reported by R. Guiteras. J. C., aged 52 years, a piano mover, 2 months previous to admission had fallen from a wagon and had the wheel pass between his legs and up over the left groin. There was severe pain and considerable shock. He was taken to a hospital where the house surgeon found a fracture of the sixth and seventh ribs, contusion of the left hip, laceration of the left pubic region with considerable hæmorrhage. Later in the day it was noticed that his penis and scrotum were very swollen and ecchymotic. Ice cap was applied to the genitals. At the end of a week the swelling and pain had diminished so that a more careful examination could be made. However, the dislocated testis was not noted. He remained in the hospital 3 weeks and improved greatly, although his penis felt sore and sensitive. When leaving the hospital he still was quite weak and had to support himself on crutches. He still remained in bed. Because of his pain, nausea, and vomiting on rising, he was referred to the author. At this time his general condition was good and he felt quite well except for pain and discomfort in the penis which was very marked when he moved around. On questioning he stated that he had had no erections since the accident, and at times urination was painful. The penis was flattened and abnormally wide at its base where it measured 5½ inches in circumference. The left side of the organ was bulging from behind the glans to the pubes, and in this region an oval mass was felt which had a peculiar elastic consistency resembling that of a testis. This mass was connected to a nodular mass at the penoscrotal junction on the left. Palpation of the nodular mass revealed an elongated body extending down into the scrotum, where it again became slightly expanded. A diagnosis of dislocation of the testis was made and closed reduction was attempted, but due to the long time since the accident this was impossible. An open reduction was then carried out. The mass in the penis was found to be the testis and

a nodular mass in the penoscrotal junction, the epididymis, which extended down into the scrotum. This evidently had been torn loose from the testis. The testis was replaced in the scrotum and the epididymis sutured around it. The result was excellent.

CASE 17. Reported by Krausch. A man 20 years of age riding a bicycle was hit by an automobile which threw him to the road and caused injury of the inguinal pubic region. On admission there was a large hæmatoma in the region of the perineum and scrotum. Examination was very difficult. Several days later the swelling had gone down and it was then noticed that the testis was not in the left scrotum. It was also noted that on the left side of the penis there was a swelling caused by an ovoid tumor directly under the skin. This tumor did not reduce in size after several days. Puncture was made of this tumor and testicular tissue obtained. An exploratory operation was then carried out and testicular tissue was diagnosed. The testis was then replaced in the scrotum. Result excellent.

This is the same case as that reported by J. D. in *La Presse médicale.*

PERINEAL TYPE OF DISLOCATION OF THE TESTIS—TWO CASES

Anterior obstruction at the penoscrotal juncture and the direction of the blow being such as to force the testis backward, it slips down subcutaneously into the perineum and lies usually a few centimeters anterior to the anus and to one side of the central tendon of the perineum. The usual position is shown in the insert (a) of Figure 1. The congenital perineal testis is not a rare occurrence; we have found well over 100 cases reported in the literature. There are, however, only two original reports of cases of traumatic perineal dislocation of the testis. The first was by W. Liddon in 1858. The patient was an artilleryman and was thrown forward while riding on the pommel of the saddle. He fell from his horse, was severely shocked, and vomited for several minutes. The next morning he noticed an extremely tender tumor in the perineum about 1 inch anterior to the anus. Several closed and open operations were attempted to maintain the testis in the scrotum, but each time it slipped back into the perineum. An orchidectomy was therefore done. As you have noticed, this is the first and only case in which an orchidectomy was necessary in all of the different types of testicular dislocations. The other case of traumatic perineal testis is that reported by Simpson in 1914. His was a man of 23, who ran with considerable force against a table, the corner of which struck him directly on the scrotum. The right testis was dislocated backward to lie under the skin of the perineum. Its position gave him a lot of pain and discomfort. It was easily replaced into the scrotum and with complete relief of symptoms. However, it was impossible to keep it there by strapping. Unfortunately, he left the hospital before an open reduction could be done and he was lost track of. There is one other case reported belonging to this type, by Bruns in 1883, but it is the same case as that reported by Liddon in 1858. The interesting features of the perineal dislocation are its extreme rarity; the force of the blow must be directly anteroposterior to the body; and it seems that a successful result is much more difficult to obtain as neither of these cases was cured. This is exactly opposite to the results obtained in all the other types of dislocation.

CASE 18. Reported by W. Liddon. Patient, B. S., aged 24 years, was admitted to King's College Hospital, April 30. He was a soldier in the artillery who 2 years ago was thrown forward while riding on the pommel of the saddle. His scrotum was injured and he fell from the horse. There was nausea and vomiting. The next morning he noticed a swelling in the perineum which was so painful that he could hardly move. He went to the hospital for treatment for 3 months without benefit. The testicle merely slid back and forth between scrotum and perineum until it now lay one inch in front of the anus a little to one side of the midline. The testis had diminished in size and was smaller than the right. At times he had difficulty in urinating and was unable to work. An open operation was therefore attempted to replace the testicle into the scrotum and to retain it there. However, 3 weeks after operation the testis had gradually slipped back to its old position. A second attempt was therefore made to anchor it into the scrotum; this was also unsuccessful. Therefore, an orchidectomy was carried out. It will be noted that this is the only one of all the cases of dislocation of the testis in which a castration was necessary.

CASE 19. Reported by J. C. Simpson. M. S., aged 23 years, came to the Episcopal Hospital, Philadelphia, November 7, 1913, with history of having run with considerable force into the corner of a table 12 hours previous. The table struck him directly in the scrotum and he had immediately suffered shocking pain in the region of the testis. There was nausea and vomiting and he was unable

TABLE I. SUMMARY OF TYPES

Type of dislocation	Author	Date reported	Age	Nature of trauma	Separation of epididymis from testis	Treatment	Result
1. Pubic	Claubry	1818	20	Wagon wheel	No	Not treated	
	Conner	1877	?	Wagon wheel	No	Closed reduction	Well.
	Bruns	1883	33	Wagon wheel	No	Not treated	
	Popow	1888	?	?	No	Not treated	
	Nicolas	1899	32	Wagon wheel	No	Open reduction	Well.
	Donovan and Ortiz	1925	?	Fall	No	Open reduction	Well.
2. Superficial inguinal	Hess	1874	31	Wagon wheel	No	Closed reduction	Well.
	Keith	1898	?	Wagon wheel	No	Open reduction	Well.
	Frederick	1912	?	Fall	No	Open reduction	Well.
	Poisson and LeRat	1912	18	Kicked in perineum	No	Open reduction	Well.
	Glauden	1922	32	Crushed between logs	No	Bilateral (1) closed reduction (2) open reduction	Well.
3. Inguinal canal	Lee	1869	25	Wearing truss for inguinal hernia	No	Closed reduction	Well.
	Hawkins	1914	24	Locomotive injury	No	Open reduction	Well.
	Hawkins	1914	11	Trolley car injury	No	Open reduction	Well.
4. Penile	Howlett	1890	65	Wagon wheel	Yes	Not treated	
	Guiteras	1890	52	Wagon wheel	Yes	Open reduction	Well.
	Krausch	1925	20	Auto wheel	No	Open reduction	Well.
5. Perineal	Liddon	1858	24	Riding horseback	No	Open reduction unsuccessful	Orchidectomy
	Simpson	1914	23	Struck in scrotum	No	Not treated	
6. Crural	Writer's case	1928	20	Auto accident	No	Open reduction	Well.
7. Compound dislocation	VanHassel	1894	20	Crushed between logs	No	Open reduction	Well.
	Summerhayes	1896	20	Crushed between logs	No	Open reduction	Well.
	Mauclaire	1914	?	Gunshot	?	Open reduction	Well.
	Writer's case	1929	45	Auto accident	No	Open reduction	Well.
8. Femoral	No authentic true cases found in the literature.						
9. Abdominal	No authentic true cases found in the literature.						

to sleep. On admission he gave evidence of great suffering while his gait was suggestive of perineal distress. Pulse rapid and thready. His scrotum, testes, and perineal region were markedly tender, sensitive to touch, and ecchymosis was present. Left testis was found in normal position, slightly enlarged, and tender, while the right was absent from the scrotum but could be palpated back under the skin of the perineum. The cord was stretched tightly from the anterior pole of the tumor to the external inguinal ring and gave pain on pressure. The perineal tumor could be easily replaced in the scrotum and by so doing pain and discomfort immediately disappeared, only to return with the recurrence of the dislocation, which readily took place. An attempt was made to retain testis in normal position by adhesive straps around the scrotum but the organ immediately glided from under the dressings to its previous position in the perineum and with return of all the symptoms. He was transferred to the ward but unfortunately escaped from the hospital, probably from fear of operation.

CRURAL TYPE OF DISLOCATED TESTIS

We were unable to find a single case in the literature belonging to this type, but fortunately we had such a case in our clinic this year which we will present. When the luxated testis meets obstruction at the penoscrotal juncture and the direction of force is such as to drive it upward and inward we have the previously described "penile testis." On the other hand, if the force drives it upward and outward with obstruction present over the inguinal region, we have the crural testis. The gland slides subcutaneously over the fibrous bands between the crural region and the scrotal neck. It then comes to lie on top of the fascia lata of the thigh. Just how far down it may travel would depend on the length of the vas and cord and the force of the blow. There is a case reported by Hess in 1874 which was again published by Bruns in 1883 and by Nicolas in 1899, which was thought to be crural in type, but on careful analysis of the case, it is quite clear that it is not a crural testis, but belongs rather to the superficial inguinal type. As they say: "the testis had been forced into the inguinal region and lay on the thigh 2.5 centimeters below the groin." This distance is so short that it can hardly be called a true crural testis. There is mention made by Nicolas of

another case of dislocated testis in the upper part of the thigh. This was caused by the pressure of a truss worn for a hernia, and we think it was most probably an inguinal testis. As no description at all is given it certainly cannot be classified as a true crural testis.

The following case report is of a man whom we had the opportunity to study in our clinic this year. So far as we have been able to discover it is the only authentically reported case of true traumatic crural dislocation of the testis.

A CASE OF TRUE CRURAL DISLOCATION OF THE TESTIS—FIRST AUTHENTIC CASE

CASE 20. On September 10, 1928, there was admitted to the Brady Urological Institute of the Johns Hopkins Hospital, a young man, (E.D.S., B.U.I. 17804), with the complaint that his right testicle had disappeared from his scrotum. His family and past history were unessential except for the fact that he had been a perfectly normally developed individual before the present illness. Both testes had been present normally situated in the scrotum. There had been no herniæ present. His present illness dates from an auto accident 5 months before admission, at which time he had been badly injured. His pelvis had been fractured; there had been a dislocation and fracture of the head of the right femur. A left direct inguinal hernia had resulted and there had been a very severe laceration in the perineum extending from the anus to the penoscrotal juncture. He had been treated for these injuries in a local hospital where it had also been noticed that his right testis was not in the scrotum. A search had located it on the inner surface of the right thigh over the region of the apex of Scarpa's triangle. Several attempts at a closed reduction had been made a few weeks after the accident but all had been unsuccessful.

The young man was apparently in good health except for the residuum of his old injuries. A left direct inguinal hernia, a relaxed left hip joint, a scar in the perineum, and an ectopic right testis. There was no indirect inguinal hernia present, nor was either external inguinal ring relaxed. No impulse was felt in the region of the femoral ring or canal, but lying subcutaneously below and medial to the fossa ovalis, at about the apex of the femoral triangle, was an ovoid tumor (Fig. 7a). This could be moved upward toward the external ring for a distance of 8 to 10 centimeters, but not sufficiently high to slip it over into the right scrotum. Pressure on it elicited typical testicular pain. Its consistency and size were that of a normal testis. The epididymis could be distinguished in its normal relationship to the gland. The vas and cord were easily made out extending from the external ring to the ovoid tumor. There was no testis in the right scrotum. The left was in its normal position. There was no doubt, therefore, that this was a case of traumatic crural dislocation of the right testis. At the time of the accident the right testis must have been dislocated from the scrotum and arriving at the penoscrotal juncture it must have met obstruction to passage either medial, inguinal, or penile and the force and direction of the blow were such as to push it down under the subcutaneous tissues of the thigh until it came to lie over the fascia lata in the region of the apex of the femoral triangle. It lay exactly 12 centimeters below the right external inguinal ring.

Attempt was made to replace this testis into the right scrotal sac, but there evidently were present dense adhesions which prevented us from doing this. Ethylene anæsthesia was then given and again an attempt was made at a closed reduction, but this was equally unsuccessful. An open reduction was therefore carried out. Incision was made similar to that for an indirect inguinal hernia repair except that it extended downward farther toward the cruroscrotal fold (Fig. 7a). As the subcutaneous tissues were retracted there appeared a perfectly normal spermatic cord coming out of the right external inguinal ring (Fig. 7b), but instead of coursing downward into the scrotum, it turned lateralward and descended beneath the subcutaneous tissues of the thigh. Attached to the end of the cord was a perfectly normal sized testis and epididymis still enclosed in its uninjured tunica vaginalis. The testis lay 12 centimeters below the external inguinal ring on top of the fascia lata and at about the apex of the femoral triangle. It could be easily forced upward as far as the cruroscrotal region, but not over into the right scrotal sac, due to dense adhesions which bound the region of the globus minor to the fascia lata at a distance of about 10 centimeters below the spine of the pubis. These dense adhesions were attached in the region of the gubernaculum testis (Fig. 7c). Great care was taken in freeing these adhesions as the vas lay in the midst of them. The tunica was opened during this dissection and resected so as to prevent the possibility of a future hydrocele (Fig. 7d). After complete delivery of the testis there was quite a sufficient length of cord and vas to replace the gland into its normal position in the right scrotal sac which had been made ready to receive its "prodigal son" (Fig. 8a). The permanent normal position of the testis in the scrotum was assured by the tissues of the dartos at the neck of the scrotum being drawn snugly around the cord. This is similar to the method of Young in performing an orchidectomy (Fig. 8b). Three sutures of medium black silk were used to make the testis secure. The wound was closed in the usual manner with black silk. A dressing was then applied with pressure at the scrotal neck and over the crural region so as to assist in preventing the testis from slipping out of the scrotum and to obliterate the dead space in the upper part of the thigh from which the testis had been removed. The wound healed *per primam* and on discharge, 10 days after opera-

tion, the right testis was situated normally in the scrotum and there was no sign of injury to the upper thigh (Fig. 9b).

COMPOUND DISLOCATION OF THE TESTIS—FOUR CASES

There remains for discussion one other group of cases which for lack of better terminology has been called herniation of the testis. We feel that this type of case should more appropriately be called "compound dislocation of the testis." In these cases there is always a tear in the scrotum, and the testis together with a part of the cord is extruded through this opening and lies outside of the scrotum. The tunica vaginalis may or may not be opened and the epididymis may be torn from the testis or be entirely uninjured. It seems to us that there must occur many such industrial accidents, but to our surprise we found only three cases reported in the literature. This is probably because most surgeons have not bothered to report them. During the past month, while this paper was being written, there came to the accident room of the Johns Hopkins Hospital just such a case.

The etiological factor is always trauma and usually such as directly to lacerate the scrotum and at the same time to compress it from above downward so as to force the testis out through the newly made opening. One case, however, reported by Summerhayes in 1896 was due to indirect violence. While at work the patient fell from a height and was crushed by a heavy log. His thighs were forced together with such violence that his scrotum was torn and the testis, together with the epididymis and a short length of cord, was extruded from the scrotum. In this case, as in one other, the tunica vaginalis was ruptured. In the two remaining cases, by Van Hassel in 1894 and Mauclaire in 1914, the dislocation was the result of direct violence.

In the case reported by Van Hassel the tunica vaginalis had been ruptured and the testis and cord were torn and bleeding. They were cleaned with iodine and replaced into the scrotum. In Mauclaire's case the tunica was not ruptured as was the condition in our patient. The treatment of thoroughly cleaning the testis and cord with a good antiseptic, iodine in these three cases and an alcohol-acetone-solution of mercurochrome in our case; removing any loose necrotic tissue, replacing the testis in the cleansed scrotal sac, and draining the wound, gave excellent results in all these cases.

Case 21. Reported by Van Hassel. The patient was a man 20 years old who had just been in an accident in a coal mine. His scrotum had been caught between a pulley and a piece of wood. Examination showed the penis to be normal, the right side of the scrotum normal. In the left lower portion of the scrotum there was a small opening through which the spermatic cord protruded for a distance of 8 centimeters. It was contused and swollen and the left testicle which was also out of the scrotum was torn and bleeding. The testis was covered with coal dust. It was washed and cleansed with sublimate. On the fifteenth day after the accident, operation was carried out, the tunica vaginalis was detached and removed. The scrotum was closed and drained and the testicle replaced in its position. Recovery excellent.

Case 22. Reported by J. O. Summerhayes. A strong, muscular man, aged 20 years, sawing a heavy block of wood, fell, and the heavy log crushed him underneath it, forcing his two thighs together. When he came to the hospital he was considerably shocked, his left testis was extruding from the scrotum. The tunica vaginalis had been ruptured and testicle had been dislocated through this and through the skin of the scrotum also. There was also a fracture of the neck of the femur. Operation was performed, the testicle was returned to its normal position, and the wound healed quite satisfactorily.

Case 23. Reported by P. Mauclaire. Patient was a soldier who was shot while lying down. The bullet had removed part of the penis near the glans and a large part of the left scrotum. Two days later the patient showed a rather extensive gangrene of the scrotum and a complete herniation of the testis. The testis was disinfected with tincture of iodine and replaced in the scrotum. Primary wound healing was obtained. Result was excellent.

Case 24. During the last month there came into the accident room of the Johns Hopkins Hospital a man of 45 (H. J., B.U.I. 18265). He was deeply under the influence of alcohol so that no history at that time was obtainable. Subsequently, we have learned that he had been struck by an auto and thrown against the curb. Patient was not in a state of shock, but was rather stuporous. This, we thought, was the result of the cheap liquor or floor polish, it often being hard to distinguish between the two, which he had quite evidently been enjoying. There was a comminuted fracture of the left wrist, lacerations around the eyes and nose, and evidence of injury to the middle third of both legs. There was also a small laceration in the left scrotum about 4 centimeters in length through which the testis, still enclosed in the

unopened tunica vaginalis, was protruding together with approximately 8 centimeters of the cord. There was present practically no local hæmorrhage or œdema. A drawing made at the time of admission is shown in Figure 10.

Due to the narcosis already present no anæsthetic was necessary. The comminuted fracture of the left wrist was reduced and set. X-ray pictures showed no fracture of the legs. With the aid of a few cubic centimeters of procain, the tunica vaginalis, cord, and scrotal sac were thoroughly cleaned with a solution containing 2 per cent mercurochrome, in 10 per cent acetone, and 50 per cent alcohol. The laceration in the scrotum was found to be a fairly clean cut through the skin and dartos, about 4 centimeters in length. The tunica vaginalis was uninjured and there was no bleeding from it or the cord. After cleaning them and the scrotal sac thoroughly the testis and cord were replaced in the scrotum. The subcutaneous tissues were approximated with plain catgut interrupted sutures and a Dakin's tube inserted for drainage and irrigation. The skin was closed with fine black silk. There was no œdema or hæmorrhage following operation. For a period of 4 days a 1 per cent solution of mercurochrome was irrigated through the Dakin's tube twice a day. After this time the drainage tube was removed, and the wound healed promptly and with an excellent result.

There remains still one case of traumatic dislocation of the testis which we came across in our search. This is a very peculiar one and a puzzle to us, as to classification. It was reported by Jurinka in 1904 "Ein Luxation Testis," in the *Zentralblatt fuer Chirurgie.*

The patient was a man of 40 years who had been run over by a wagon. At the time of the accident the right testis disappeared and could be found nowhere, although a very careful examination was made. An exploratory operation was carried out and still no sight of the lost member. As the surgeon was about to abandon the search, the right thigh was rotated and suddenly quite unexpectedly the lost testis popped out of the right hip joint. This seems to us very fantastical and if it is true, it is certainly the only case on record of a ball-bearing hip joint (with apologies).

SUMMARY

Traumatic dislocation of the testis is far less common than cryptorchidism or aberrant migration of the gland. As in congenital ectopic testis, so in traumatic dislocation, we have correspondingly similar types. The resultant location of the dislocated testis is dependent upon the force and direction of the blow; anatomical anomalies; and the presence or absence of obstruction. There are three groups of dislocated testis. First, there is the superficial or subcutaneous dislocation. In this group we have the following types: superficial inguinal, pubic, penile, perineal, and crural. Second, there is the internal group or those in which the testis passes within the external inguinal ring. In this group there are the inguinal, femoral, and abdominal types. Third, there is the compound dislocation of the testis in which it is extruded through a wound in the scrotal skin. In the literature, since the year 1800, we have found reports of 23 original cases of traumatic dislocation of the testis. The number of cases belonging to each type was: pubic, 6; superficial inguinal, 5; penile, 3; perineal, 2; in the inguinal canal, 3; and compound dislocation, 3. There are no authentic reports of a traumatic femoral, crural, or abdominal testis. We present in detail a new case of traumatic crural testis which we believe to be the first of its kind to be reported. There are only three cases of compound dislocation of the testis in the literature, though we feel that this must be a rather common industrial accident. We present a new case of this type also. The etiology, symptoms, physical signs, diagnosis, treatment, and results in the cases belonging to each type have been discussed and our conclusions are that the diagnosis and treatment of this condition is usually relatively easy and the ultimate results excellent. The case histories have then been presented briefly of each of the 23 cases classified into the various anatomical types.

CONCLUSIONS

1. Cryptorchidism occurs in from 0.1 to 0.2 per cent of all young adults.

2. Aberrant migrations of the testis are less common than cryptorchidism. The perineal type is the most common, over one hundred having been reported.

3. There are 13 cases of transverse ectopic testis in the literature.

4. A careful survey of the literature has brought to light only 23 original cases of traumatic dislocation of the testis. We add 2 more cases.

5. The resultant position of the dislocated testis is dependent upon 3 factors: (1)

anatomical abnormalities; (2) obstruction to dislocation in particular directions; and (3) the direction and force of the blow.

6. There are three groups of cases: the internal or those in which the testis passes through the external inguinal ring into the canal; the superficial or those in which it does not pass into the canal but lies subcutaneous; and the compound dislocation of the testis.

7. In the first group are the femoral and inguinal canal and abdominal types.

8. In the subcutaneous group we have five different types; pubic, superficial inguinal, penile, perineal, and crural.

9. The etiological factor was, in the majority of cases, the passage of a wheel over the genital region.

10. Symptoms were severe shock and local pain with nausea and vomiting.

11. Diagnosis was usually very easy, after the traumatic swelling had disappeared. Early diagnosis was often very difficult.

12. In only two cases, both penile, was the epididymis torn from the testis.

13. Treatment was very satisfactory; reduction without open operation was accomplished in only 3 cases; open reduction in 16. Six cases were not treated.

14. All the cases were cured except one perineal testis which could not be held in its correct position and had to be removed.

15. There were only 3 authentic cases reported in which the testis had been dislocated within the inguinal cord. These were associated with some previous anatomical abnormality.

16. There were no cases of traumatic femoral or abdominal testes on record.

17. There were 6 cases of the pubic type, this being the most common. Three were not treated and 3 were cured by open reduction.

18. The superficial inguinal type comes next with 5 cases. One case was not treated; all the others were cured by open reduction.

19. There were 3 penile dislocations. One was not treated and the two others cured by open operations.

20. Only 2 cases of traumatic perineally dislocated testis were found. One was not treated and the other necessitated orchidectomy as it could not be retained in the scrotum. This is the only patient in all the cases of dislocations not cured by operation.

21. There is no authentic case of a true traumatic crural testis on record. The new case reported here, we believe, is the first. Open reduction was easily done and a cure obtained.

22. Herniation, or as we have called it, compound dislocation of the testis, must be rather common although there are only 3 cases in the literature. A new one is reported in detail.

23. The prognosis in all these dislocations of the testis is excellent.

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SPINAL ANÆSTHESIA FOR THE HEAD, NECK, AND THORAX; ITS RELATION TO RESPIRATORY PARALYSIS[1]

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ALMOST every reference work on spinal anæsthesia mentions the danger of respiratory paralysis as a result of the action of the drug upon the medullary centers. The idea conveyed in most instances is that, because of diffusion, the drug ascends in the spinal canal from the point of injection (usually in the neighborhood of the second, third, or fourth lumbar vertebra, and if it reaches the medulla, depression of the respiratory center takes place to such an extent that paralysis ensues.

Various anæsthetic solutions of known specific gravity have been advocated as possessing special advantages in that the direction of diffusion could be limited and the medulla thus safeguarded from fatal depression. During the past 18 months, experience has taught us that it is advisable to induce (rather than to guard against) diffusion to the medulla and brain stem in order to secure anæsthesia of the entire body. During the past 4 years, we have employed spinal anæsthesia routinely on all cases needing operations on structures below the diaphragm, and in the past year and a half its scope has been broadened to include all operations on structures above the diaphragm with the exception of those cases in which anæsthesia was required for a period so brief as to make it not worth while (for example, ambulatory cases needing incision and drainage of fingers, abscesses, etc.).

Before the adoption of our method of inducing head anæsthesia, experiments were undertaken to determine the safety or danger of the method. Particular interest was centered upon the effect of the anæsthesic agent on the medullary respiratory center. In our clinical studies of complete body anæsthesia (which now number over 750 cases) we have not met with serious respiratory or cardiac embarrassment. When such anæsthesia is induced, it is self-evident that the anæsthetic solution affects the sensory roots at the upper portion of the cord as well as the bulb. How else could anæsthesia be explained? Indeed, we can induce sleep by the same method and, where sleep results, the anæsthetic agent must of necessity have come into contact with the sensory cortex.

In an earlier paper in which one of us recounted experiences with spinal anæsthesia, some physiological evidence was presented to show that the anæsthetic agents did not have the effect upon the medulla which had previously been ascribed to them, and that, furthermore, there was a selective affinity for sensory nerves. In this paper more direct evidence will be presented.

METHOD

Frogs were used. The cervical cord and medulla were exposed, the subarachnoid space was opened, respirations were noted, and then a cotton pledget dipped in a solution of neocaine (1/10 gram in 4 cubic centimeters of saline) was applied directly to the medulla and upper cervical cord. There was no apparent visible effect on the respiratory movements of the animal in spite of the fact that the proportion of the anæsthetic was much greater than that used in humans. The same experiment was tried with guinea pigs. The guinea pig was anæsthetized with ether, the upper cervical cord and medulla were exposed, the dura was incised, the subarachnoid space was opened, and the animal was allowed to come out of the anæsthesia. Pledgets of cotton soaked in neocaine solution were applied directly to the cord and medulla and the animal was kept in Trendelenburg position of 8 to 10 degrees for one-half hour. During this time there was no visible effect upon the respiratory movements. At the expiration of one-half hour the pledgets containing the anæsthetic solution were removed, the cord and medulla were washed with saline, and the wound was cleaned. There was no effect upon respiration but the

[1]Read at the fifth annual meeting of the American Society of Regional Anesthesia, April 2, 1929.

Fig. 1.

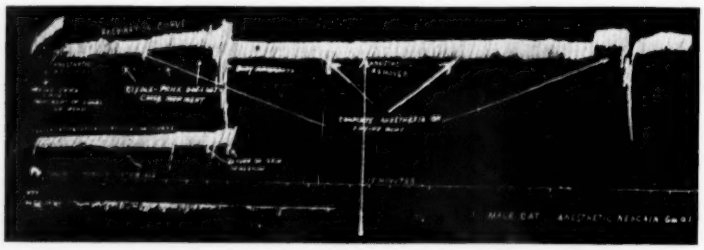

Fig. 2.

Fig. 1. Semi-diagrammatic representation of the exposed upper cervical cord, medulla, and cerebellum of the cat with the subarachnoid space opened, upon which a pledget of cotton soaked in neocaine solution (0.1 gram dissolved in 4 cubic centimeters of normal saline) is applied.

Fig. 2. Record of respiratory movements obtained by sewing a thread into the ventral aspect of the lower portion of the chest wall of a cat upon whose exposed upper cervical cord and medulla a pledget of cotton soaked in neocaine solution (0.1 gram dissolved in 4 cubic centimeters of normal saline) has been applied.

animal died the following morning of meningitis, no attempt having been made to maintain sterility. During the time the anæsthetic agent was applied to the cord and medulla, there was complete anæsthesia of the entire body as shown by failure to elicit response when the skin was pricked or cut. The animal appeared somnolent. The experiment was repeated in several guinea pigs with the same result, there being at no time any visible evidence of respiratory change. A similar application of anæsthetic solution was made in a cat (Fig. 1). With the animal lying free on the operating table without a head holder, a tracing of respiratory movements was obtained by means of a thread, one end of which was sewed into the ventral aspect of the lower portion of the chest wall, the other end being connected to a lever which recorded on a smoked drum. At the expiration of 4 minutes a pledget of cotton soaked in the neocaine solution was supplied to the medulla and upper cervical cord and respiration recorded for the following 15 minutes. After the first few minutes, there were body movements made by the animal which gave wide excursions on the drum surface, but, subsequently, the animal remained quiet throughout the experiment. Before the solution of neocaine was applied, pricking the skin over any part of the body elicited a movement of the animal. One minute after the application of the neocaine, pricking the skin was not followed by any response. Cutting the skin of any part of the body (including the head and neck) was not followed by a reaction. The application of the anæsthetic was continued for 15 minutes; the pledgets were then removed and the cord and medulla were washed with saline and covered with a sponge soaked in saline. For the next 30 minutes or 45 minutes from the time that the neocaine was first applied, pricking of the skin elicited no movements of the body. In other words, up to that time there was perfect anæsthesia. Forty-five minutes after the application of the anæsthetic solution to the upper cervical cord and medulla and 30 minutes after the solution had been removed and washed away the anæsthesia began to disappear. This was made manifest by responses of the body and limbs to pricking. During all this time, however, there was no change in the respiratory movements nor was there any period of apnœa. A few minutes later the anæsthesia was apparently all gone because pricking of the skin elicited very active movements. This was true of all parts of the body (Fig. 2).

SECOND GROUP OF EXPERIMENTS

The entire brain of a frog was destroyed, the spinal cord being left intact. The sciatic nerves were exposed in both thighs after the animal had recovered from the shock. At this stage pricking of any one of the extremities would elicit a response in the shape of a kick.

Fig. 3. Spinal frog with exposed sciatic nerves to one of which neocaine solution has already been applied.

A pledget of cotton soaked in the neocaine solution was wrapped around the nerve for a distance of about 1 centimeter. In 3 minutes, the pinch reflex of that hind limb was abolished. The same thing was done to the other sciatic nerve and again in 3 minutes the reflex was abolished. An electric stimulus supplied by an induction coil, one dry cell of one and one-half volts being used, with the secondary coil directly over the primary, when applied to either hind limb, gave a slight local contraction of the muscle but no kick. When applied to the dorsal spine in the interscapular region, there was a forceful contraction and kick of both hind limbs. Stimulation of the sciatic nerve below the level of the application of the anæsthesia resulted in a kick of the same limb but not of the opposite. Stimulation above the level of the anæsthesia application gave a contraction of both hind limbs. To determine whether the complex reflex was due to electrical spread along the muscle and skin tissues or to nerve conduction, the stimulus was changed from an electrical one to a mechanical one by the substitution of fuming nitric acid. Application to the hind legs of a small piece of filter paper soaked in 1 per cent nitric acid gave no response. Application to the inguinal region gave very forceful response from both hind limbs (Fig. 3).

Stimulation of the brachial plexus of one side by the induction current gave very forceful contractions of both lower extremities. These experiments were repeated in several frogs and the observations confirmed.

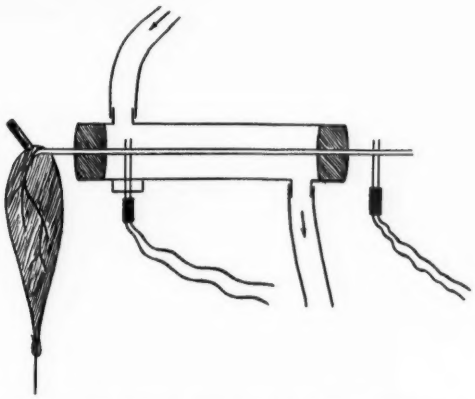

Fig. 4. The nerve of a nerve-muscle preparation is passed through a glass tube which is made air-tight by plugs of normal saline clay surrounding the nerve at the two ends of the tube. By means of two lateral tubulures, narcotic vapor is passed through the tube. The nerve is alternately stimulated by two electrodes, the inner testing the action of the drug on excitability, while the outer shows the effect on the conducting power of the nerve within the chamber.

DISCUSSION

If the effect of the solution injected into the subarachnoid space upon the medulla is dependent upon the solution reaching the medulla by diffusion, the rate and degree of which cannot be controlled by the operator, the results cannot be as accurately studied as they can when the application of the anæsthetic agent is made directly to the medulla. Especially is this so since the effect of the anæsthetic upon the nerve tissue is quantitative. If paralysis of respiration results from the diffusion of the drug from the lower portion of the spinal subarachnoid space where it is injected (i.e., at the level of the second lumbar vertebra) to the medulla, the same effect, namely, paralysis, should be produced more readily, more easily, and more quickly by the direct application of the anæsthetic agent to the medulla. By such direct application there would not be any loss occasioned by diffusion; nor would there be a diminution in the concentration of the anæsthetic solution. The maximal effect, if the anæsthetic causes depression, should, therefore, be obtained. If, as some claim, diffusion from the lower portion of the spinal subarachnoid space is ordinarily so slight that the amount of anæsthetic

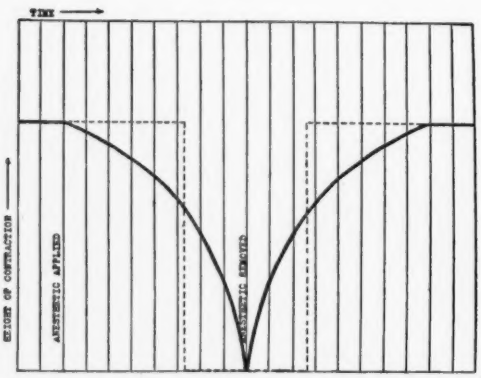

Fig. 5. Graph of outer electrode; response showing effect on conductivity (interrupted line). Graph of inner electrode; response showing effect on excitability (black line).

agent which reaches the medullary portion of the cerebrospinal system is insufficient to cause enough depression to result in respiratory paralysis and that only occasionally does the concentration of the diffused anæsthetic which reaches the medulla become great enough to induce respiratory depression and paralysis, then by the direct application of the concentrated solution one should *always* be able to induce such respiratory depression and paralysis.

In our experiments, direct application of concentrated solution to the medulla, the relative anæsthetic content of which was proportionately far greater than that in the human, did not result in any such respiratory depression or paralysis. It seems paradoxical that anæsthesia can be produced by the action of an anæsthetic agent on sensory fibers without producing an effect upon such a delicate mechanism as the respiratory center. Consideration, however, of the results obtained in our second group of experiments and also of our knowledge of the pharmacological action of the anæsthetics of the cocaine group presents an explanation for the apparent inconsistency.

In our experiments, after the application of the neocaine solution to the sciatic nerve, failure to get a pinch reflex of the corresponding hind limb meant that there had been an interruption in physiological continuity of the sensory nerve. In the same animal, when the stimulus was applied to the dorsal spine in the interscapular region and there was a resultant forceful contraction and kick of the hind limb it became apparent there had been no interruption of conduction through the motor fibers of the sciatic. Quite apparently, then, the anæsthetic agent had a selective affinity for sensory nerve tissue. With this in mind, it is not so difficult to understand how an anæsthetic solution which diffuses up to the medulla or at least up to the level of origin of the phrenic nerve, namely, the third, fourth, and fifth cervical nerve roots, could cause ablation of sensory conduction or could anæsthetize the sensory fibers without any effect whatsoever upon the motor fibers contained in that nerve or in the nerve tissue.

Santesson found that direct contact with a 5 per cent solution of cocaine hydrochloride broke sensory conduction so completely that the strongest possible tetanic stimulation peripheral to the anæsthetized area was no longer able to produce a response; while the same concentration of anæsthetic left motor conduction unchanged for about one hour. Alms found that he could interrupt sensory conductivity with a far greater dilution of anæsthetic than he could motor conductivity.

In studying various types of motor nerves in the vagus trunk above and below a cocainized area, Dixon determined that centrifugal cardio-inhibitory fibers lose their conductivity while the centripetal, reflexly-acting respiratory and circulatory fibers retain their conductivity.

There are many other examples of the difference between the sensory and motor elements. Sensory nerve endings are poisoned by cocaine and not affected by curare. Motor endings are paralyzed by curare. Ammonia is a very strong stimulant to sensory endings in a wound, producing violent pain, but has scarcely any effect on motor endings. This partial selective affinity of the anæsthetics of the cocaine series for sensory nerves is only one expression of a general rule governing the reaction of sensory and motor fibers to other anæsthetics. Hitzig first demonstrated the disappearance of cerebral cortical sensibility long before the abolition of motor functions. "Even when every trace of reflex has disap-

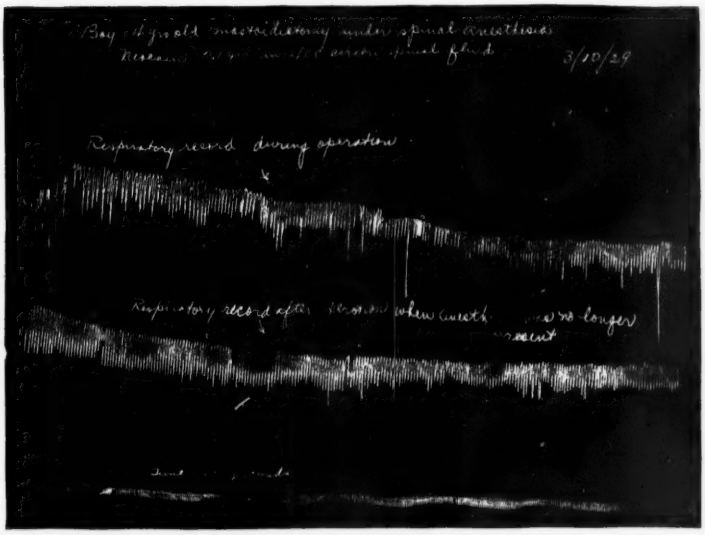

Fig. 6. Respiratory record in a male child 4 years old during and after a mastoidectomy under neocaine spinal anæsthesia (neocaine 0.1 gram dissolved in 4 cubic centimeters cerebrospinal fluid) obtained by a pneumograph placed around the lower portion of the thorax. The upper tracing represents the respiratory excursion of the ribs during the anæsthetic period while the operation was being performed, and the lower is a record postanæsthetic and postoperative breathing movement.

peared and when the most intense sensory stimulation, such as pulling on the dura, and strong induced currents applied to the mucous membranes of the nose produce reflexes no longer, certain cortical motor areas still respond to stimuli." Morphine, though administered intravenously, does not abolish cortical motor function; whereas it has a profound effect upon the cortical sensory area. Bernstein demonstrated the parallelism between the spinal cord and the cerebrum as regards the effect of chloroform and ether on the motor and sensory fibers. He blocked the circulation to the lower part of the cord and thus protected it from the chloroform circulating in the blood. The motor apparatus of the upper part, although exposed to chloroform, still responded to impulses coming from the lower part of the cord, while the sensory mechanism in the poisoned section remained completely insensitive. It appears, therefore, that everywhere in the central nervous system the motor mechanism is particularly resistant to anæsthetic action.

It is now not so difficult to understand how respiratory movements initiated by a purely automatic motor center may be maintained despite the existence of such a degree of poisoning by an anæsthetic as has brought about an interruption of conductivity in sensory fibers. It is this property of selectivity (dependent upon inherent differences in nerve fiber, endings, and cells) which is so important a factor in the explanation of the phenomenon of surgical anæsthesia of the entire body without respiratory paralysis. Thus, it becomes apparent that, in the average case of spinal anæsthesia in which no fatality has resulted, the lack of respiratory paralysis is not due to any particular good fortune whereby there has been too little diffusion of the anæsthetic toward the medulla in sufficient concentration to cause the dreaded effects but rather to the fact that the respiratory center is a station for the initiation of motor impulses and possesses, inherently, properties that render it immune to the effects of an anæsthetic in the concentration advocated for spinal

anæsthesia. At this point it might be well to state that those who employ solutions heavier or lighter than cerebrospinal fluid in order to limit the height of anæsthesia below the level of the medulla by controlling the degree of diffusion need no longer worry. Experimental and clinical evidence have clearly demonstrated that even were the solution to diffuse as they fear it might, a fatal termination due to respiratory paralysis would not follow.

It must be remembered that the action of the anæsthetic agent on nerve tissue depends upon an affinity between it and the lipoid substances in the nerve as well as upon a physicochemical solubility reaction occurring at a point of application. The anæsthetic agent is very rapidly fixed by the lipoid reaction. Lipoidal tissues have an affinity for anæsthetics and unite with them with considerable avidity. It is, therefore, difficult to understand how solutions, even of a specific gravity differing from that of the cerebrospinal fluid, can be made to diffuse upward or downward by the tilting of the table 5 or 10 or more degrees some time after the fluid has come in contact with the nerve tissue. The anæsthetic substances in solution are very rapidly fixed by the nerve tissue with which they come in contact. Thereafter, as far as diffusion is concerned, it matters not how the position of the patient be changed. There are other reasons for altering the position in spinal anæsthesia. In support of this idea is the evidence that in the animal to whose exposed medulla an anæsthetic solution has been applied for 15 minutes, the thorough washing off of the excess of anæsthetic with saline solution does not result in a disappearance of the anæsthesia. The latter persists for an additional 30 minutes (Fig. 2).

Complete anæsthesia of the entire body (including the head and neck) developed in the animals in which the anæsthetic was applied to the medulla and upper cervical cord. They also became somnolent. This means that not only was there an interruption of conduction along the sensory fibers of the upper cervical and cranial nerves but also diffusion toward the cortex was secured in sufficient concentration to produce sleep. This idea is confirmed by clinical observations. In many patients, particularly in children, where head anæsthesia is induced by encouraging diffusion of the drug upward toward the medulla, it is found that sleep results. This can be explained only by assuming that the anæsthetic causes a depression of the activity of the cerebral cortex. Thus, not only is it safe to allow and expect upward diffusion of an anæsthetic agent introduced at the level of the second or third lumbar vertebra, since this diffusion is bound to diminish the concentration of the drug to a point far below any possible dangerous action, but also it is safe to apply this anæsthetic solution directly to the medulla and upper cervical cord in a concentration much greater than it could ever attain by upward diffusion. That there is some effect upon respiration seems likely inasmuch as the automaticity of the centers is to some extent controlled by afferent impulses transmitted through the vagi or from other sections of the brain. The temporary ablation of these impulses, however, can in no way seriously affect the organism. The center has sufficient inherent automaticity of its own, dependent upon and regulated by the metabolic activity of its constituent parts, controlled by the reception of physicochemical stimuli supplied by the blood.

There is another factor which, possibly, may contribute to the phenomenon of the interruption of sensory activity without the abolition of the development and propagation of motor impulses from the respiratory center. Nerve fiber possesses two distinct properties: namely, excitability and conductivity.

That these properties are separable has long been known. If part of the nerve of a frog gastrocnemius-ischiadicus preparation be enclosed in a chamber into which anæsthetic vapor can be introduced and the nerve stimulated by two electrodes (Fig. 4), one within the chamber and the other peripheral to the chamber, and the muscular responses charted, a graph such as is shown in Figure 5 will be obtained. It is seen that the responses from the muscle on stimulation by the chamber electrode begin to diminish in amount as soon as the vapor comes in contact with the nerve, and this diminution increases by a definite decrement as the anæsthetic continues its

action. The peripheral electrode through which a stimulus of the same intensity is sent evokes a response which continues without decrement even though the anæsthetic action proceeds. Ultimately, however, when the response to the stimulation by the chamber electrode has diminished considerably in amplitude, but is still present, there is a sudden and complete cessation of response to stimulation by the peripheral electrode. Continued application of the anæsthetic results in further gradual diminution in amplitude of response to stimulation by the chamber electrode until finally zero is reached. Removal of the anæsthetic vapor from the chamber and continued stimulation at both points show an immediate and gradual return in amplitude of response on stimulation by the chamber electrode and a much later, sudden, and complete return of maximal response on stimulation by the peripheral electrode.

This can be interpreted only as meaning that with the vapor acting on the nerve within the chamber, there is a gradual loss of irritability of the contained part of the nerve, whereas the unaffected portion of the nerve remains normally excitable. As the anæsthetic continues its action and gradually diminishes the excitability of the contained portion, during which time the external portion of the nerve retains its excitability as is shown by maximal response, there is a sudden change in the nerve within the chamber which has the effect of preventing the impulse generated in the highly excitable nerve by the peripheral electrode from passing down to the muscle. In other words, the conductivity is interrupted. The interruption of conductivity always comes quite some time before the excitability is completely lost. Applying this to the action of anæsthetic solutions on the medulla and upper cord, it can be seen that it is possible to have anæsthetic action to the point of interruption of sensory impulses in nerve fibers and yet be far from a complete depression of excitability of nerve cells. Thus, sensory impulses enroute to the cerebrum may be stopped in the medulla because conductivity is interrupted, whereas the cardiac and respiratory nerve centers in the medulla, although their excitability is lowered, can still initiate motor impulses in response to the physicochemical stimuli furnished by the blood. This factor and the selective affinity of the cocaine group anæsthetics for sensory fibers explain the possibility of complete anæsthesia of the entire body without respiratory or cardiac failure.

CLINICAL APPLICATION

These experimental facts have enabled us to employ spinal anæsthesia in every form and type of operative procedures encountered in an active surgical service. The height of the anæsthesia is regulated by the amount of spinal fluid utilized for dissolving the drug. The greater the amount of cerebrospinal fluid withdrawn, the greater will be the amount of diffusion and, therefore, the higher the level of anæsthesia. This is in accordance with the well known physical law that the diffusion of liquids under pressure is inversely proportional to the pressure. The diminution of the cerebrospinal fluid pressure caused by withdrawing a greater amount of liquid causes greater diffusion of the re-injected fluid. The details of the technique of inducing the anæsthesia have been thoroughly described in a previous paper.

Every spinal tap and every injection of an anæsthetic solution is made in the interspace between the second and third lumbar vertebræ. We have found that 1/10 gram of neocaine dissolved in approximately 4 cubic centimeters of cerebrospinal fluid (the amount necessary to fill one ampoule) is sufficient for the average operation below the diaphragm if completion can be expected within 50 minutes. If anæsthesia of the thorax and head is desired, 250 milligrams of neocaine dissolved in 8 cubic centimeters of cerebrospinal fluid injected between the second and third lumbar vertebræ are used. This method applies to adults and children above the age of 7 or 8 years. Under that age the dose must be diminished proportionately. Between the ages of 5 and 8, head anæsthesia can be obtained by means of 150 to 200 milligrams of neocaine dissolved in 6 cubic centimeters of fluid. Between the ages of 2 and 5 similar anæsthesia may be obtained with 100 to 150 milligrams of neocaine dissolved in

4 cubic centimeters of fluid, and below the age of 2 head anæsthesia can be obtained with from 5/100 to 1/10 of a gram dissolved in 3 cubic centimeters of cerebrospinal fluid. This form of anæsthesia fulfills all the requirements of an ideal anæsthetic as no other method does. The desiderata of the satisfactory anæsthetic are safety, universal applicability, maximal relaxation, blandness in the sense that tissue irritation is not produced, ease of administration, and freedom from shock. In the past 4½ years, we have used spinal anæsthesia routinely. We have never come across any cases in which we found its use contra-indicated except in cerebellar neoplasms and diseases of suppurative nature of the spinal column or of the overlying tissues at the site or in the neighborhood of the injection point. The advantages of this form of anæsthesia over any other form in abdominal operations and in fracture work have been thoroughly discussed elsewhere (6). In thoracic operations, it is especially indicated because of the relaxation and the calm respiratory excursion which accompanies its use. In empyema it is of considerable value. With local anæsthesia, a rib may be resected with facility but almost always, when the cavity is opened to drain off the pus, no matter how slowly the latter is allowed to escape, there is a very distressing and sometimes dangerous dyspnœic period. This is avoided entirely when spinal block anæsthesia is used.

An interesting phenomenon in head anæsthesia is the absence of complete motor paralysis of the upper extremities and head. This is frequently of considerable value, as for example, in the repair of lacerated tendons of the hand or fingers. It is of considerable advantage to be able to test out the action of the tendon by attempts to secure voluntary motion. This, of course, is not possible under any form of inhalation narcosis.

The advantages that have been voiced for spinal anæsthesia over ether anæsthesia in abdominal and lower extremity operations hold also for operation on the upper extremities, thorax, and head. Except for the local trauma of the needle during introduction, there is no tissue irritation. This is in marked contrast to the effect of ether on the respiratory mucosa. Anyone who can do a lumbar puncture can induce spinal anæsthesia. The method is reasonably "fool proof." But very few movements are necessary. No situation where individual judgment is required ever arises after administration. The only time where judgment is called into play is in varying the dosage according to the age of the patient. Spinal anæsthesia effectively prevents operative shock. The blockade of shocking impulses coming from the operative field has a very beneficial influence on the central nervous system and is at least as efficacious in producing the anociassociation of Crile as is local injection. It has very definite value in operative procedures in patients having advanced cardiac disease. Here, particularly with failing compensation, greater strain is placed upon the right side of the heart. The induction of anæsthesia is accompanied by an effect comparable to that of phlebotomy, the drainage of blood into the abdominal veins. The fall in pressure rests the heart, and its burden is considerably lightened throughout the duration of the anæsthetic. In advanced pulmonary diseases complete freedom from pain can be readily produced without dangerous irritation to the mucosa of the tracheobronchial tree common to inhalation anæsthetics. In the late stages of renal disease it is highly essential to minimize anæsthetic irritation of the kidneys. All forms of inhalation narcosis are more irritating than is spinal anæsthesia. This is especially noticeable in older individuals. It is also particularly true of alcoholics. The latter not only require much greater amounts of inhalation anæsthetic but usually have associated renal involvement. Such patients give far fewer premonitory symptoms of impending disaster with inhalation narcosis than does the average case. For this reason, also, spinal block is indicated. Patients having hypertension may be operated upon to advantage under spinal block. Ether and nitrous-oxide raise the general blood pressure and are, therefore, not well borne by hypertension cases. In the aged anæmic or cachectic patient needing surgery the problem of anæsthesia is ideally solved by spinal block. By the substitution of spinal block for inhalation narcosis, the latter exert-

ing a hæmolizing effect on the blood and causing irritation of the kidneys and bronchial pulmonary tree, there is eliminated what would otherwise be a much greater operative tissue insult.

Spinal anæsthesia is the most suitable form of anæsthesia in operative procedures for the treatment of osteomyelitis. The shocking impulses attendant upon bone trauma by the chisel and mallet are short-circuited. The deleterious effect of profuse hæmorrhage is diminished by the relative anæmia occasioned by the "splanchnic phlebotomy." The abolition of the cough reflex by profound inhalation anæsthesia is unquestionably a factor in the production of aspiration pulmonary complications. The elimination of such complications of inhalation anæsthesia is accomplished by root block. Surgery in metabolic diseases such as diabetes, nephrosis, exophthalmic goiter, and particularly in those diseases associated with acute toxæmias, as eclampsia and emesis gravidarum, should be done only under root block to avoid many of the unpleasant and dangerous features of the inhalation anæsthetics already mentioned. Surgery of the deeper tissues of the neck which involves some traumatism to the trachea is bound to be complicated by the irritating effect of inhalation narcotics upon the tracheal mucosa. In this type of case, spinal block is also particularly indicated. Although the school of surgeons who use inhalation narcosis in surgery of the thyroid (especially in exophthalmic goiter) has a large number of followers who claim that local anæsthesia has very little if any advantage over inhalation narcosis in this particular field, it would seem as though there could be very little doubt that spinal block supersedes both inhalation narcosis and local anæsthesia. There is no distortion locally of the tissues as there is with infiltration; there is not the increased tendency toward acidæmia which invariably accompanies inhalation narcosis; the avoidance of irritation to the mucosa of the tracheobronchial tree has already been mentioned; shocking impulses from the operative field are all interrupted. Indeed, if there be any site above the diaphragm where there is need of an ideal form of anæsthesia it is with this type of surgery. The requirements are met by spinal anæsthesia.

Inhalation anæsthetics are best given to patients who have been properly prepared. Such anæsthetics administered without adequate preparation in emergency surgery (for example, after a full meal) complicate operative procedures and may be productive of grave postoperative sequelæ. Emergency surgery may be performed under root block without these drawbacks. This is particularly true in emergencies such as those complicated by concomitant pulmonary infection.

In our clinical studies on humans of the effect of spinal anæsthesia on the respiratory movements, we find results which are comparable to those obtained in the cat. If respiratory movements are recorded on a drum by means of a tambour connected to a kymograph, it is seen that the downward movements which correspond to inspiration and the upward movements which correspond to expiration are both followed by a slight expiratory pause. Similar records in patients who have been subjected to spinal anæsthesia show no change except a slight diminution in the amplitude of the excursion and also an increase in the length of the expiratory pause. This is true not only of cases in which anæsthesia reaches a level of the diaphragm or the nipple line but also in cases in which head anæsthesia had been induced. Figure 6 shows the respiratory curve taken by means of a pneumograph from a child who was operated upon for mastoiditis under spinal anæsthesia. A comparison of the pre-operative and operative respiratory excursions shows a diminution in amplitude of movement and an increase in the length of the expiratory pause. In spite of the fact that there was anæsthesia of the sensory nerve to the face and head which means that the anæsthetic must have reached the level of the upper portion of the medulla, there was no respiratory paralysis. As has been stated in many texts and as would perhaps be expected if the pharmacological fact were ignored, there should at least be a paralysis of the intercostal muscles, the muscles which raise the ribs during inspiration. However, these graphs which were taken by means of a pneumograph placed around the chest wall

and which represent the amplitude of excursion of the ribs and not of the diaphragm are evidence of the fact that the respiratory muscles and their innervation are not interfered with by an anæsthetic which reaches the level of the upper portion of the medulla and which, all along the pathway of diffusion, affects sensory roots springing from the spinal cord and brain stem.

The literature on spinal anæsthesia contains many references to blood pressure changes. We have kept careful records of blood pressure variations in several thousand cases and have arrived at the conclusion that it is impossible to predict in any case with any degree of accuracy what will happen to the pressure after the injection of the anæsthetic solution. In some instances there is no appreciable change. Other patients show a maximal fall of about 10 millimeters of mercury. A fairly large number have a drop in pressure of between 20 and 30 millimeters within 10 minutes after the time of injection, this fall being sustained for approximately three-quarters of an hour, the return to normal immediately preceding the return of sensation. In some instances the drop is from 50 to 75 millimeters within 10 minutes, and within another 10 minutes there is a return to about 20 millimeters below the normal. In at least 5 per cent of all cases the pressure drops within 10 minutes to such a level that no radial pulse can be felt nor can the pressure be registered by the manometer. At first this manifestation was quite alarming and all types of stimulation were resorted to. Intravenous administration of adrenalin, caffein, strychnine, etc. were all tried. The effect of these drugs, however, if any, is transitory. It was soon noticed that even without the use of drugs the pressure returns to a higher level within a very short period (approximately 10 minutes) if the Trendelenburg position is maintained. Should this state of affairs occur during an intra-abdominal operation, the operator can readily reassure himself regarding the condition of the patient by palpating the abdominal aorta in which slow, regular pulsations can be distinguished. However, should such an exploration not be possible, the uninitiated surgeon might easily become alarmed. It is no exaggeration to state that in over 250 cases out of our total series (4,500) the anæsthetist (whose only duties during the anæsthetic period is to record the blood pressure and respiration during the entire operative procedure) notified us that it was impossible to secure a blood pressure reading by means of the manometer. Of late, when we receive such information, nothing is advised. Our experience has taught us that, ultimately, the pressure will return and no untoward effect be occasioned as long as the patient remains in the Trendelenburg position.

The physiological reasons for the fall in pressure—the details of which are given elsewhere (6), in brief, are as follows:

The nerve control of the blood vessels is regulated by two antagonistic sets of fibers; one, constrictor, and the other, dilator. The vasoconstrictor fibers leave the spinal cord by way of the anterior roots of the spinal nerves from the first dorsal to the third or fourth lumbar nerve, inclusive, to go by way of the white rami communicantes to sympathetic ganglia. The major portion of the fibers forming the white rami from the lower seven dorsal and upper two or three lumbar roots unite to form the splanchnic nerve. The upper two or three lumbar roots often take a separate course and are referred to as the lesser splanchnic. The greater splanchnic nerve supplies all the blood vessels of the abdominal viscera with constrictor fibers. Section of this nerve causes a tremendous fall in the general blood pressure because of the great dilatation of all the blood vessels in the abdominal cavity. The dilatation may be so extensive that the splanchnic vessels may contain all the blood of the body. In spinal anæsthesia, which is essentially a block anæsthesia, there is an interruption of the impulses passing through the roots. Among other intercepted impulses are those which supply vasoconstrictor stimuli to the vessels. The failure of the vasomotor constrictor impulses to reach their destination results in a marked relaxation of the vessels. Since this type of anæsthesia affects some if not all the lower dorsal roots, many splanchnic constrictor impulses are interrupted. The number of roots affected

determines the amount of fall in blood pressure. If all the roots supplying the constrictor fibers to the abdominal blood vessels are involved, the fall in blood pressure resulting from the tremendous relaxation of these abdominal vessels may be so great that no manometric estimation can be made. When this occurs, there is no sign, whatsoever, of cardiac failure. Although the contractions of the heart are forceful, their output rapidly decreases, the zero point being approached in time due to a diminution of the quantity of venous blood brought to the right ventricle. The principle factor maintaining venous flow is the vis a tergo produced by the ventricular contraction on a closed system of vessels possessing elastic walls in which a definite degree of tonicity must be maintained by constrictor impulses. With a marked dilatation of the blood vessels within the abdominal cavity and the consequent tremendous fall in blood pressure the venous return flow to the heart becomes so inadequate that not enough blood can be pumped out to the brain. The latter, however, must always secure a normal amount of blood. Failure to supply the blood to the brain in sufficient quantity results in a bulbar and cerebral anæmia which is responsible for death in spinal anæsthesia. The fault is not due to failure of the myocardium. Nor is the fatality occasioned by primary respiratory paralysis. When respiratory paralysis ensues, it is consequent to the cerebral anæmia resulting from failure of the veins to supply sufficient blood to the cardiac chambers to allow the active heart to pump enough to the brain. The condition is comparable to that of an internal hæmorrhage, the bleeding being into the relaxed vessels of the abdominal cavity in which the venous pressure is nil and from which no blood is being returned to the heart. Such a state of affairs can be counteracted in only one way and that is by the utilization of the Trendelenburg position. This insures sufficient gravity drainage from the veins to the heart whence enough blood is quickly relayed to the brain by the body's active and competent pump. Thus is a fatal cerebral anæmia forestalled. Our experience in many cases in which there was no recordable brachial artery pressure for a considerable period of time has convinced us that with the patient in Trendelenburg position there is no danger from spinal anæsthesia, irrespective of the amount of blood pressure fall. It is for this reason, also, that we feel, despite the citations to the contrary with which the literature on spinal anæsthesia is replete, that hypotension is in no sense a contra-indication to the use of this form of anæsthesia. We have operated upon many patients with ruptured tubal pregnancies in whom, in spite of treatment for shock and hæmorrhage, the pressure did not rise above 55 millimeters of mercury, with perfect equanimity regarding the effect of the anæsthetic and we have had no reason to change our opinion.

Regarding the marked variations in pressure-fall following the application of the anæsthetic to the spinal nerve roots, it might be mentioned in explanation that separating the motor from the sensory roots in the spinal canal is the ligamentum denticulatum, an irregular cribriform membrane. This separates the canal into an anterior and posterior compartment. When the anæsthetic solution is introduced into the subarachnoid space, it usually enters the posterior compartment and diffusion into the anterior compartment, in which lie the anterior roots containing the vasomotor constrictor fibers, is dependent to a certain extent upon the number and arrangement of the perforations in the separating ligament. Only near the site of puncture is the anterior diffusion great enough to affect thoroughly the anterior roots and their contained vasomotor fibers. When the needle penetrates the ligamentum subflavum and enters the posterior compartment of the subarachnoid space, if it is pushed farther, it separates the nerve bundles forming the cauda equina and may enter the anterior compartment. Should this occur, if the anæsthetic fluid is now injected, more anterior roots will be affected and more vaso-constrictor impulses will be blocked so that the pressure-fall will be greater. It becomes evident, then, that the partial control of the blood pressure fall depends upon injecting the anæsthetic fluid into the posterior compartment of the subarachnoid space.

As to vasomotor stimulants, it might be mentioned here that we consider them of little aid. Those drugs, the action of which depends upon their effects on the vasomotor centers, are, of course, of little value. Impulses emanating from these centers could not pass the blockade. The only drugs which might have any value are those which act directly upon the blood vessels; and even here we are confronted by a condition in which it is almost impossible to get enough of the drug to the desired region to secure any worth while effect. If adrenalin be given intravenously in a normal animal, the vessels (particularly of the internal vascular area) respond to its constrictor action with a marked rise in blood pressure. Plethysmographic investigation reveals that the kidney and spleen decrease considerably in volume so that the curves taken from these organs move in a direction opposite to those of the blood pressure. The blood pumped out of the internal organs is forced toward the heart. The rise of blood pressure which follows the intravenous administration does not as a rule last longer than from 1 to 3 minutes because of the very rapid destruction of the adrenalin due to the fact that oxidation takes place in the alkaline solutions of the body tissues. Adrenalin has a direct action on the heart, increasing the rate and strength of systole. This effect corresponds to the stimulation of the accelerator nerve. This, too, is quite transitory. When adrenalin is injected into an individual or an animal in whom spinal anæsthesia has been induced, the effect must necessarily be different, and, unfortunately, the greater the need of the effect the less is the desired result. The marked fall in blood pressure in such a person or experimental animal resulting in venous stasis prevents the adrenalin from reaching the desired point where its action is most needed, namely, the dilated, splanchnic vessels. Too small a quantity is carried to this area to secure any valuable local reaction.

It was the realization of this state of affairs which probably prompted Babcock to advocate the intravenous saline injection in cases of severe collapse following spinal anæsthesia induced by the method he employed. The injection of saline solution under gravity pressure into the veins insures liquid contents for the heart chambers upon which the cardiac muscle can contract and which can be sent out into the circulation to help maintain the activity of the center.

With this form of anæsthesia the most frequent complication encountered is postoperative headache which occurs in about 10 per cent of the cases. In most of these the headache is very mild and is not appreciated until the patient attempts to sit up when it varies from slight dizziness to slight pain. Occasionally, the headache is quite severe and the patient is very uncomfortable. The application of the magnesium sulphate enema method for lowering the cerebrospinal pressure used in head injury cases immediately controls the headache in almost all instances. Six ounces of 50 per cent solution of magnesium sulphate every 4 hours in enema form is the method employed. One patient who did not respond completely to this method yielded to a spinal puncture through which 40 cubic centimeters of fluid were removed from the canal. Other complications such as two cases of diplopia, one case of parsæsthesia of the buttocks and anal region, and one case in which there was some atrophy of the extensors of the left leg are discussed in detail elsewhere (6).

Postoperative urinary retention is not an infrequent complication which may be accompanied by constipation. The knee jerks are exaggerated in these cases. The condition is usually cleared up after one or two catheterizations. Rarely does it persist for more than 4 or 5 days. It must be remembered that most of these complications are phenomena that have been recorded after simple lumbar puncture. The greater the amount of fluid removed, the more likely will symptoms develop. It is characteristic of these symptoms that while the patient is in the horizontal position they usually lessen or disappear entirely, whereas with every attempt to gain the sitting or erect posture they are markedly aggravated. An explanation has been advanced that the orifice made in the subarachnoid space by the needle often fails to close for some time after its withdrawal and allows continual oozing through the puncture. The loss of

fluid in this way in itself probably has no effect in the production of symptoms which are most likely the result of some degree of irritation to the meninges. Even slight extravasations of blood may cause serous meningitis which in turn results in increased fluid production and consequent symptoms.

In a study of the effect of blood in the cerebrospinal fluid, Bagley recently showed that as soon as blood is liberated and mixes with the cerebrospinal fluid there is some irritation of the meninges probably comparable to the chemical peritonitis which is induced in the peritoneum when free blood escapes. In all likelihood this plays an important rôle in the production of headache as the result of lumbar tap. We have had no experience with the treatment of this form of headache by the injection of small quantities of air into the subarachnoid space.

In a very small number (not more than four) of intractable cases which did not respond to the magnesium sulphate treatment we have had occasion to do a spinal puncture and allow the escape of from 10 to 15 cubic centimeters of cerebrospinal fluid. This procedure always resulted in a cure.

It is understood that the attitude toward spinal anæsthesia discussed in this paper may be considered quite revolutionary, but a careful review of the literature will satisfy one that this method not only is not a new one but also that it has been employed in thousands of cases by men like Jonnesco, Lefiliatre, and many others. In this country there are references to the use of spinal anæsthesia for head operations back as far as 1901 in which year mastoidectomies and enucleations of the eye were reported (Payne). Among the reasons for the method having been placed in the discard in all likelihood was the adverse criticism based purely upon theoretical speculations and not upon the accumulation of scientific data.

Not knowing anything regarding the selective affinity of the cocaine anæsthetic group for sensory nerves, how easy it would be to imagine that the effects of diffusion of the anæsthetic solution within the spinal subarachnoid space up to the higher levels of the cord and the medulla would produce a fatal respiratory and cardiac paralysis. One could not avoid reaching an erroneous conclusion as a result of logical reasoning based upon false premises, which is exactly what has happened. Throughout the country the number of fatalities reported as a result of the use of spinal anæsthesia without observing the precautions necessary to avoid a cerebral anæmia (which is really responsible for the fatality) has done much to delay the progress and the more universal acceptance of spinal anæsthesia as an anesthetic.

The experience of the authors with head anæsthesia over a fairly large number of cases has convinced them not only that the method is safe but that it is universally applicable. In all fairness it must be mentioned here that the anæsthesia has not been perfect in all cases. There have been instances where the patient has complained of painful sensations. This is attributed to inexperience on the authors' part because it is believed greater familiarity and a larger series of cases will so modify the dosage and the amount of fluid extracted from the cerebrospinal system as to enable complete and accurate control of the amount of diffusion of the drug and the amount of concentration of the drug at any desired level. In this connection it must be remembered that the spinal subarachnoid space is divided into two compartments, an anterior and posterior, by the ligamentum denticulatum which contains many apertures. If the needle which is introduced into the spinal subarachnoid space is pushed through between the fibers which form the cauda equina so that it reaches the anterior compartment, there will be greater diffusion along the anterior compartment than there will be along the posterior compartment. This will modify the amount of drug reaching the upper cervical cord and medulla. Variation in the position of the needle point in the spinal subarachnoid space is in all likelihood responsible for the few cases in which there has been failure to get complete and satisfactory anæsthesia. It is believed, however, that here, too, greater familiarity with the method will result in complete control of the anæsthesia.

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UNUSUAL BONY INJURIES ABOUT THE HIP JOINT[1]

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INJURIES to the osseous structures in and about the hip joint are either common or rare depending upon the age period in which they occur. Some conditions, however, are uncommon at any period and offer difficulty in diagnosis even with the roentgen-ray. Key points out that contusion to the joint is uncommon due to the deep seated position of the joint and the accurate coaptation of the joint surfaces; while the strength of the muscles and ligaments about it gives adequate protection against sprain.

CERVICAL FRACTURE

Fracture of the neck of the femur is without question the most frequent lesion found but is limited to the period from 50 years upward. In the period between 20 and 40 years, fracture of this type is very infrequent because the strength of the neck is greater than that of the shaft, and the latter therefore gives way first.

We have now under treatment a young man of 34 years who sustained a transcervical fracture of the femur when he fell from a second story window. The signs were typical of a neck fracture but on account of his age, clinical diagnosis was withheld until examination was made with the roentgen-ray.

The Whitman abduction treatment, as followed out in this case and illustrated, is our method of choice in the uncomplicated cases irrespective of age (Fig. 1).

In children and adolescents, traumatic epiphyseal separation, as well as the type of coxa vara acquired gradually in patients overweight, is the condition most frequently manifested and should be definitely differentiated from actual fracture, as it often occurs without immediate complete disability and, if not corrected early, is followed by limitation of motion and slight shortening (Fig. 2).

DISLOCATION

Traumatic dislocation of the hip is generally regarded as a relatively frequent occurrence but constitutes only about 2 per cent of all dislocations and is limited to the period considered as the prime of life. In this period, however, fractures of the shaft are much more common than are dislocations. The dorsal dislocation is the usual type encountered, and roentgen-ray examination in these frequently reveals fragments of bone torn away from the rim of the acetabulum by the strong ligaments or broken off by the impact of the dislocating head. Occasionally the entire superior rim of the acetabulum may be carried upward by the head, as in the case coming under our observation. At attempted reduction, the fragment of rim entered the acetabulum in advance of the head and thus rendered reduction of the dislocation impossible except by open operation. Open reduction was performed and, after the rim was lifted from the acetabulum, the head of the femur was easily skidded into the cavity. The fragment was then fixed in its proper position by a temporary steel drill, driven through it and into the ilium. One end of this drill extended out through the wound and was easily removed after 3 weeks.

Very rarely there is a fracture of the head of the femur associated with dislocation, an entity which will be discussed under a separate heading. Bigelow, in his classical article on dislocation of the hip, does not mention asso-

[1] From the private clinic and University Hospital service of Drs. Lord, Schrock, and Johnson, University of Nebraska, College of Medicine.

ciated fractures, as the roentgen-ray was then unknown and these complicating factors could not be recognized clinically due to the deep seated position of the joint.

The unusual feature of traumatic dislocation is its rarity in children. Moffei, in reviewing 1,842 dislocations, found only 3 in young individuals, 2 patients being under 10 years and the other, 14 years of age. In the literature only 49 cases were found by him. Choyce, in 1924, reported 6 cases from the University College Hospital, London; and analyzed 53 from the literature. He points out the relationship of Legg-Perthes disease to this trauma which occurred in 2 cases while a third developed rarefication of the femoral neck with pathological dislocation. These complicating conditions occurred about 1 year after injury and were considered due to loss of the vascular supply by way of the ligamentum teres. This, in my opinion, warrants plaster fixation following dislocation as brought out farther on in this paper.

We have the opportunity here of presenting two additional cases; one being a posterior dislocation in a boy of 9 years with no evidence of epiphyseal injury. The mechanism of the injury in this patient was quite characteristic for dislocation. He was struck on the flexed knee with the thigh also flexed on the trunk and the direction of the force paralleling the shaft of the femur. Reduction was accomplished with little difficulty and after a period of plaster immobilization for 1 month he had almost full range of motion and no limp (Fig. 3).

The second patient was a boy of 4 years who 17 days previous to admission to the University Hospital had slipped and fell so that he was completely disabled. His pain was then localized in the left knee region which was placed in a plaster cast. Disability continued so he was sent in for diagnosis. On examination a clinical diagnosis of dislocation of the hip was made on the findings of thigh flexion, internal rotation, and prominence of the greater trochanter which was well above Rose-Nelaton's line. The misleading knee pain at the time of injury undoubtedly was referred pain as occurs in inflammatory lesions of the hip. Another unusual finding was the rather free mobility of the head of the femur at the time of our examination; the usual complete fixation of traumatic dislocation not being present (Fig. 4). Reduction was not difficult and immobilization consisted of a hip spica cast for 1 month. Examination 4 months after injury was negative; however, we will keep this boy under observation for at least 1 year in order to avoid any complications as observed by Choyce.

In the review of his cases, Moffei considered that the failure in reduction is usually due to ineffective application of traction preliminary to manipulation. He insists on the application of a carefully molded cast following reduction. In the old cases, he recommends open reduction without an attempt at closed manipulation as the latter procedure is uniformly unsuccessful. Our personal experience confirms Moffei's opinion as to preliminary traction as well as plaster immobilization after reduction. The latter is obviously indicated where fracture of the rim of the acetabulum has occurred, in order that union may take place with a minimal traumatic arthritis. The Bigelow method of reduction needs only passing mention as all are familiar with the procedure. In his own words: "Flexion lies at the foundation of success in the reduction of femoral dislocation; and compared with this the rest of the manipulation is of secondary importance." The various modifications adopted in reducing dislocations have the same underlying principles. The avoidance of additional trauma by unnecessary roughness in the manipulation has been stressed by Denuce in his method and carried out by us both in the congenital and traumatic cases. The thigh is first flexed sharply on the trunk and rotated inward. The knee is carried over the abdomen well to the opposite side and with one hand controlling it and pushing in the longitudinal axis of the thigh, the other hand guides the head as it descends posterior and inferior to the acetabulum. The knee is then carried across the body to its own side and downward to the surface of the table. As the extremity is brought down from its position of flexion, abduction, and outward rotation toward the anatomical position, the head slips into the acetabulum with a decided jump. The diffi-

culty encountered in some instances has been that the head was forced too low by the pushing maneuver and carried into the anteroinferior region with the subsequent abduction. Needless to say complete relaxation by general anæsthesia is essential for this procedure, although Dshanelidze states that he reduces all dislocations without anæsthesia or assistance.

CASE REPORT

CASE 1. A farmer of 34 years was thrown from a vehicle in a runaway sustaining injuries to the right upper and lower extremities, with complete disability. When examined 48 hours later his right lower limb was in the position of semiflexion, adduction, and internal rotation. The greater trochanter was quite prominent and high. Roentgen-ray confirmed the diagnosis of dorsal dislocation of the femur and revealed in addition a fracture of the upper rim of the acetabulum. Reduction was obtained by the procedures as outlined in detail above and the check-up X-ray examination disclosed that even the displaced fracture of the rim had returned to its proper position. A hip spica cast was worn for 6 weeks, and he returned to work as a rural mail carrier 10 weeks after the injury. Six months later a follow-up letter informed us that he was entirely symptom-free (Fig. 5).

CASE 2. A very similar type of injury was sustained by another man 53 years of age. One would think first of a fractured neck of femur at this age rather than dislocation. It proved, however, to be the latter and reduction was easily accomplished 6 hours after the injury. In spite of 8 weeks' immobilization, weight bearing was painful for over a year although range of motion was practically complete. His age undoubtedly accounted for the persistent although decreasing irritation of the joint.

Anterior dislocation of the hip is quite rare and the mechanism of injury is that of extreme abduction. The usual deformity is slight flexion, abduction, and external rotation; the latter is increased in the pubic type of dislocation and the head can be readily palpated. In obturator dislocation the signs are less positive. An outstanding clinical sign in all dislocations is the absolute fixation of the extremity and this is important in differentiating the lesion from that of fracture.

Reduction of this dislocation is usually accomplished by flexion and abduction as the first step. In this position the thigh is rotated inward then adducted and extended. During the entire maneuver considerable traction should be employed. In old anterior dislocations Watkins summarizes the hindrance to reposition as due to (1) construction about the femoral head by the torn capsule, (2) the formation on an adventitious capsule, and (3) contracture of the fascia lata and gluteus medius. He reports a case of 3 months' standing in which open reduction was performed successfully, the capsule being opened and the fascia lata divided.

ACETABULAR FRACTURES

Central fracture of the acetabulum with or without central dislocation of the head is an unusual and difficult fracture problem. This lesion is limited to the middle age period although a few cases have been reported in children and the author's patient, a boy of 11 years, discussed in detail elsewhere makes it seem probable that separation of the fragments of acetabulum along the lines of embryonal origin as suggested by Vaughn is not as uncommon as considered, for the roentgen-ray does not give us accurate evidence if the separation is only slight, as in my case. However, here the necropsy examination revealed a separation three-sixteenths of an inch wide at the epiphyseal line between the os pubis and ischium. Kreuscher found no case reported under 18 years of age. His patient, a girl of 12 years, was thrown to the sidewalk when struck by a car, alighting squarely on the greater trochanter. She was treated 3 days for a sprain before positive diagnosis was made. An interesting complication was the development, 8 months after recovery, of a destructive lesion in the region of the epiphysis. A four plus Wassermann was found and with antiluetic treatment and rest the local condition cleared up entirely.

If the trauma is marked enough to produce wide separation, the head is permitted to pass through the aperture and thus we have the central dislocation. If this luxation is marked, the fragments of the acetabulum may close together, grasping the neck so that closed reduction becomes impossible. In Vaughn's case this proved to be the complicating factor which made reduction very difficult even when a lever was passed through the acetabulum over the head and the latter pried back from its locked position. Kleinberg mentions the rarity of the condition and reports 3 cases all

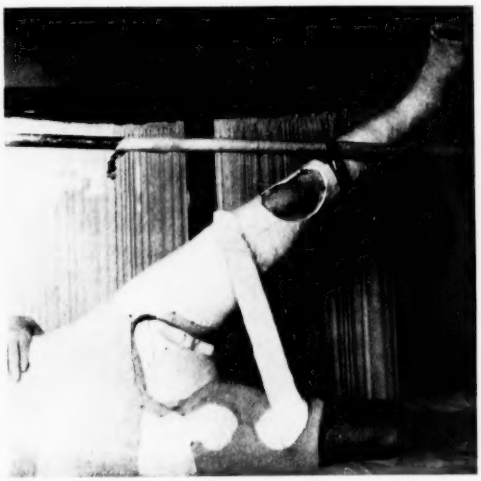


Fig. 1. Abduction cast for transcervical fracture of left femur.

Fig. 2. a (left), Traumatic epiphyseal separation in a girl of 12 years. b, Check-up film after reduction by traction and abduction. Note slight overcorrection. Perfect functional result at end of 3 months.

in the thirties. He stresses the importance of determining injuries to bladder, blood vessels, or other important pelvic structures. Vaughn, in reviewing the literature, finds 26 cases positively this type of lesion and 33 doubtful.

The mechanism of the injury is very characteristic. A fall of considerable severity, the patient striking on the greater trochanter has constantly been the type of injury sustained. Crushing injuries of the pelvis may produce fractures which extend into the acetabulum as in a case of the author with a fracture of os pubis which coursed obliquely into the joint.

Considering the number of these cases seen late, the diagnosis is far from simple. Whitman, who reports 6 cases, states as there are no evident signs of fracture the injury often passes as a contusion. He cites a case of suspected pelvic tumor which at operation proved to be the head of the femur in the pelvis.

The clinical findings in this condition as noted by most observers and as found in our patient is that of slight flexion, adduction, and internal rotation. Boorstein points out that, with this deformity, the head is driven backward and inward toward the ischium. In receiving an injury of this type, the thigh would be apt to be flexed to a variable degree and thus fixed in the position found. There is also apparent flattening over the greater trochanter but shortening is very slight. The first thought is that of the more common dorsal dislocation, but here the deformity is more extreme while in impacted fracture of the femoral neck, the above deformity would be absent. Whitman states that in all late cases abduction has been lost and weight-bearing is painful. The indication then is to secure abduction which in itself tends to reduce the dislocation. In the early cases the treatment, therefore, is the Whitman abduction method similar to the procedure used in cervical fractures. In our experience, very extreme abduction was necessary to prevent redislocation, and we would recommend at least 10 weeks of complete fixation and an additional 3 months in a walking caliper splint. Coley permitted weight-bearing in his patient at the end of 3 months with a satisfactory end-result as to painless weight-bearing and with about

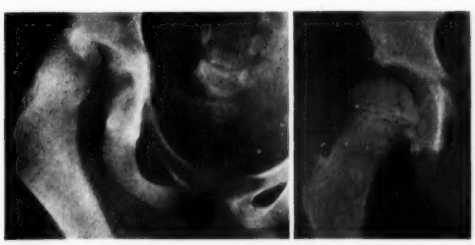


Fig. 3. a (left), Posterior dislocation of right hip in boy of 9 years. b, Check-up film after reduction.

Fig. 4. a (left), Boy 4 years of age with traumatic dislocation of hip. b, Check-up film before application of cast.

75 per cent range of motion. If reduction is impossible by manipulation in the old cases, Whitman recommends subtrochanteric osteotomy to secure functional abduction.

It has been the experience of the writers reviewed by the author that the end-result even in the cases seen early is that of a deep acetabulum with fair range of motion but usually painless weight-bearing. In females with displacement of the fragments into the pelvis, subsequent pregnancies should be closely guarded due to the alteration of the parturient canal. In the late cases, the permanent disability is considerably greater especially as to range of motion.

Case 3. A lady of 28 years was thrown from a horse, alighting on the right great trochanter. Two days after injury, when first seen by Dr. Lord, the clinical picture was that of posterior dislocation of the hip. The region over the greater trochanter was very much flattened and the shortening was about three-fourths of an inch. The roentgen-ray film was most interesting (Fig. 6). A fracture of the acetabulum with central dislocation of the head was found as well as a fracture of the ascending ramus of the os pubis. Reduction of the head was not difficult but maintenance of position was unsuccessful until the extremity was dressed in a degree of abduction much greater than we usually employ for fractures of the neck of the femur. She was immobilized in a cast for 2 months, following which a walking caliper was used for 3 months. The functional end-result 3 years after injury is very satisfactory in spite of a deep acetabulum which limits complete abduction (Fig. 7).

We feel that a long period of protection is necessary for this type of fracture as the load

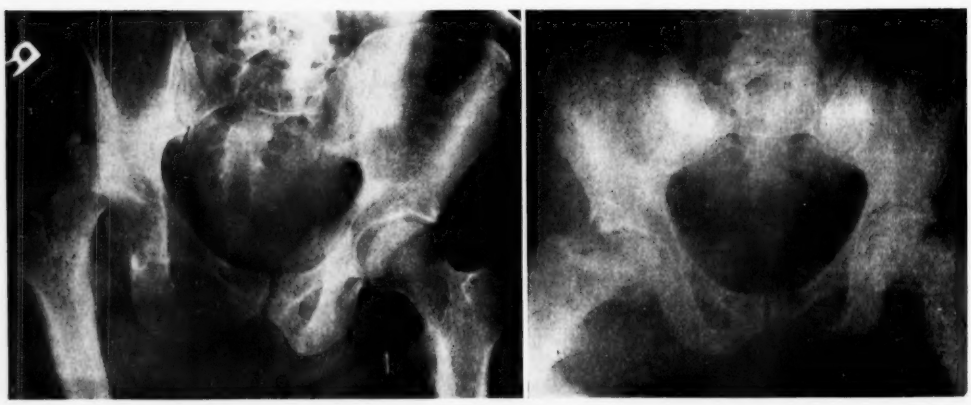
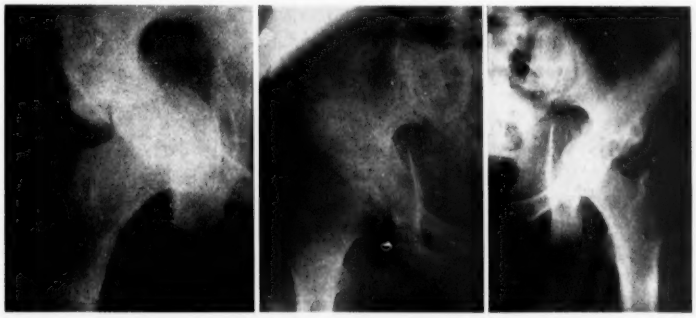
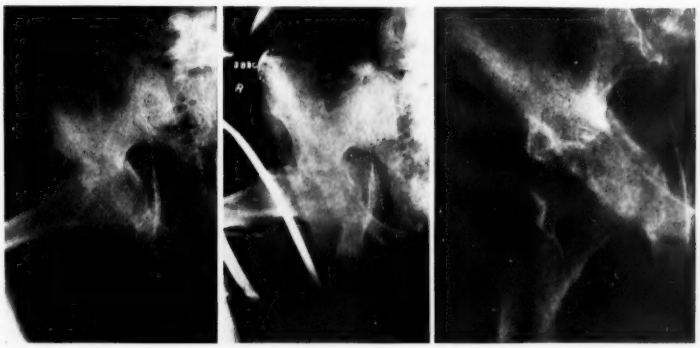


Fig. 5. a (left), Traumatic dislocation of the hip with chip fracture of the superior rim of the acetabulum. b, Reduction with almost exact replacement of detached fragment has been accomplished.



a b c

Fig. 6. a, Central fracture of acetabulum with central dislocation of the head of the femur. b, Reduction by traction alone. c, Recurrence of dislocation.



a b c

Fig. 7. a, Reduction of central dislocation by extreme abduction. (Same patient as in Figure 6.) b, Reduction maintained by Thomas splint and traction. c, End-result 3 months after injury showing deep acetabulum with shadow of new bone bridging defect. Displaced spicule of bone incorporated in callus forming new roof of acetabulum.

of the trunk is carried on the roof of the acetabulum and a very strong bridge must be formed before full weight should be permitted.

CAPITAL FRACTURES

Fractures of the head of the femur are very rare. Christopher was able to collect only 9 proved cases. All were the result of very severe injuries and associated with posterior dislocation. The etiology apparently is that of impact of the dislocating head against the rim of the acetabulum. Burkett, in 1869, reported the first case of this type. The fragment of the head to which the ligamentous tissue was attached remained in the acetabulum and the other portion with the shaft of the femur was posterosuperior. The line of fracture was in the same plane as the vertical axis of the shaft which would substantiate a shearing mechanism with the rim of the acetabulum as the cutting edge.

Moxin's postmortem report in 1872 is interesting. In part: "the head of the thigh bone lay an inch outside the great sciatic nerve, free under the remains of the glutei. A portion of the head of the bone remained in the hip joint, attached by the round ligament. Evidently on the displacement of the bone some violent force, taking advantage of the leverage the limb afforded, had forced the head of the

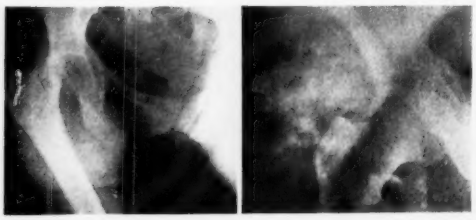


Fig. 8. a (left), Fracture head of femur with posterior dislocation of neck. Head in acetabulum. Very satisfactory position as revealed by roentgen-ray through plaster.

femur to plough its way among the muscles. None but a very enormous violence could effect such a terrible injury."

In 4 of the 9 cases reviewed in detail by Christopher, death resulted from the injuries. Three of the remaining 5 had ankylosis as an end-result; and 2, including his own, recovered completely.

Treatment consists of reduction of the dislocation, and if check-up roentgen-ray films reveal poor position of the fragments, the operative removal of the loose portion is obviously indicated in order that even a fair functional result may be obtained.

Dr. Schrock of our clinic has now under treatment a woman in the forties who in an automobile accident sustained this type of injury as shown in the roentgen-ray (Fig. 8).

Due to the very severe shock, attempt at reduction was delayed for 3 weeks during which time, however, traction and suspension were used. Under general anæsthesia, manipulation as used in the usual dislocation was carried out and the check-up ray through the plaster cast revealed very satisfactory position. However, there is great probability that the fragment of head will absorb due to nutritional deficiency.

A similar type of injury, except that greater comminution was present, is found in a patient under Dr. Lord's care. Here attempted reduction failed and subsequent operation for the removal of the detached fragment of head was performed. The neck of the femur was then placed in the acetabulum and maintained in position by abduction and also by transposition of the greater trochanter with the attached gluteal muscles down on the shaft of the femur. This patient is now in plaster and

Fig. 9. a (left), Comminuted fracture dislocation of hip in a middle aged man. b, Check-up film after removal of head. Neck of femur in acetabulum with greater trochanter attached to shaft of femur by temporary steel drill.

with the case of Dr. Schrock's will be reported in detail when maximum improvement has been reached (Fig. 9).

Durand and Destot have reported 3 cases of fracture of the head of femur without dislocation. The results all have been disappointing as to range of motion and painless weight-bearing. This type, seemingly, is very rare.

TRACTION FRACTURE—LESSER TROCHANTER

The epiphysis of the lesser trochanter appears at approximately 12 years of age and fuses with the shaft at 18 years. Traction fracture of this process, therefore, is an injury of adolescence and review of the literature reveals that 80 per cent occur during this period.

Very frequently, in intertrochanteric fractures, the lesser trochanter is broken free from the shaft but this is not produced by a traction mechanism and no report is found of this occurring independent of cervical fracture.

Balensweig, in 1924, reported 5 cases bringing the total to 38. With the advent of the roentgen-ray, many have been recognized as a definite bone lesion, whereas previously a diagnosis of sprain would have been justified on the symptoms and signs.

Straining, as in jumping or vaulting, is the usual cause of this injury. Langdon, in studying 2 cases, describes very accurately the mechanism. The body is suddenly thrown backward with consequent strain on the iliopsoas muscle as an attempt is made to assume the upright position. This detaches the tro-

Fig. 10 (left). Traction fracture of lesser trochanter in young athlete of 16 years. Perfect functional result at the end of 2 months.

Fig. 11. Fracture of greater trochanter with displacement. Patient not completely disabled but with increasing symptoms until support was afforded.

chanter, which is pulled upward a variable distance. Disability as a rule is not complete, but a dragging limp develops which usually increases. Flexion of the thigh is difficult but in the recumbent position may be partially possible due to the action of the tensor fascia femoris and rectus femoris. In the sitting position further flexion is not possible and this is known as Ludloff's sign. These patients also assume a protective trunk flexion of slight degree when standing and tend to list toward the side affected.

Treatment is best carried out by plaster fixation with thigh flexion of about 45 degrees and slight adduction. With wide separation, 90 degrees would be better, although check-up roentgen-rays usually show no change in the position of the fragments in spite of the flexed position. In the mild cases which show simply a separation through the epiphysis as compared with the other side, rest in bed for 2 or 3 weeks gives satisfactory results. Complete recovery in the average case occurs at the end of eight weeks (Fig. 10).

FRACTURE OF GREATER TROCHANTER

Very little is found in literature of fracture of this process. The author has had the opportunity of treating one case. A man standing on a short ladder, misstepped, sustaining an obliquely directed blow to the greater trochanter. Disability gradually increased but walking was possible. The roentgen-ray disclosed a linear fracture along the base of the trochanter which was slightly displaced (Fig. 11). A heavy figure-of-eight strapping and bandage of the lower pelvis and upper thigh proved to be adequate fixation. Recovery was complete in 6 weeks.

CONCLUSIONS

We again wish to emphasize the definite age periods for the various traumatic lesions of the hip, the importance of determining the mechanism of injury when possible, and the usual conditions which should be borne in mind when a case presents itself for diagnosis.

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KRUKENBERG TUMOR OF THE OVARY

With Report of Two Cases

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ALTHOUGH cases of this comparatively rare tumor undoubtedly had been previously reported, it remained for Friederich Krukenberg in 1896 with a report of five cases and a detailed description of the gross and histological characteristics to make a definite differentiation between it and the ordinary malignant growth.

He called it fibrosarcoma ovarii mucocellulare (carcinomatodes) which name shows that he considered it as primarily a fibrosarcoma with elements in its structure resembling carcinoma. He described it as a solid ovarian tumor, almost always bilateral, usually associated with ascites, characterized by a general growth of the entire ovary, and usually free of adhesions. He describes the histological picture as that of a stroma of fibrosarcoma inclosing in its meshwork the characteristic cells or groups of cells which identify it. These are large, swollen cells with a mucoid protoplasm and with the nucleus often displaced eccentrically to form the signet ring appearance. He believed the tumor to be primary in the ovary.

Since the original description by Krukenberg, the most noteworthy study of this interesting growth was made by R. H. Major in 1918, who, after a careful search of the literature, collected 55 authentic cases including one of his own. His conclusions, after a study of these cases, were that histologically the tumor is essentially a carcinoma containing elements of fibrosarcoma; that it is not often primary but usually secondary to carcinoma elsewhere and usually to that of the stomach or intestines; that it is bilateral in 90 per cent of the cases collected; and that it is so malignant that in all cases reported in the literature, where the later course was known, the patients have died. Major's own case was particularly interesting because the diagnosis of carcinoma of the stomach could not be made in the gross but required serial sections to establish this diagnosis. In his case, also, typical Krukenberg carcinoma cells were found in the pulmonic circulation.

The writer, in an effort to collect the cases reported since Major's article in 1919, has found 23 additional ones including the 2 reported for the first time in this paper.

In 1920 Chapman described a Krukenberg tumor removed from a child, 14 years of age, which is the youngest case yet reported. This tumor was bilateral and at operation a tumor of the stomach was palpated but not removed. There was no autopsy.

In 1921 Reel added a case, that of a single woman aged 21 years, with the primary growth apparently in the stomach but with additional involvement of the omentum, mesenteries, anterior surface of the spleen, and the large and small intestines.

In 1925 Miller reported 2 cases: one in a woman aged 36 years, a unilateral growth probably secondary to carcinoma of the pylorus; and the second in a woman, age unrecorded, but with tumor secondary to an inoperable tumor of the bowel.

In 1926 Shaw reported 5 cases in one of which carcinoma of the stomach was found; in 3 of which carcinoma of the stomach was a probable diagnosis, and the final case was lost to view without completed study.

In 1926 Miner described an apparently primary unilateral Krukenberg tumor which was well one year following operation.

In 1924 Gordon reported a bilateral tumor of the Krukenberg type in a negress, aged 39 years; this was associated with carcinoma of the pylorus.

In 1927 Jarcho added 7 cases, 6 of which were from European clinics. In 6 of these cases studied to conclusion, all had gastric carcinoma. One patient disappeared before a complete study could be made.

In 1927 Bell reported 3 cases of Krukenberg tumor, one being unilateral.

To add to the comparatively meager literature on the subject and to describe some

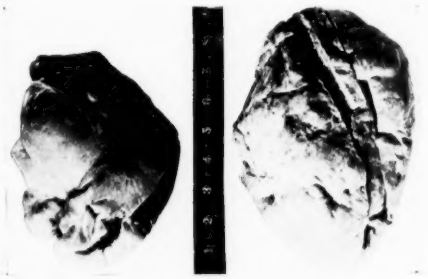

Fig. 1. Case 1. J. B.

characteristics which are unusual in this type of tumor, I wish to report two cases.

For the privilege of reporting the first case, I am indebted to Doctors V. R. Mason and M. C. Terry, of Los Angeles.

J. B., a woman, aged 43 years, consulted a doctor in 1924 for gastric hæmorrhage. Studies were made at the time and a diagnosis of gastric ulcer was made. A few months later a tumor was discovered in the pelvis and in February, 1925, the abdomen was opened. The uterus and adnexa were removed because both ovaries were found to be replaced by moderately large tumors and the uterus was myomatous. The stomach was palpated and an indurated area was found which was thought to be an ulcer. This area was not removed. The tumors were sent to the laboratory of Terry and Woods, Los Angeles, who made a diagnosis of Krukenberg tumor of the ovaries. The following is taken from Dr. Terry's pathological report: "The right ovary alone measures 13 by 8 by 7 centimeters and weighs 250 grams. The left ovary, which remains attached to the uterus, measures 8 by 7 by 5 centimeters. . . . Both ovaries have preserved somewhat their original shape. The surface of each is irregular. Half of the left ovary is dark and hæmorrhagic in color.

Microscopic examination shows the same picture in both ovaries; namely, a rather loose abundant connective tissue framework in the spaces of which are large round or oval cells apparently distended with mucus. The nucleus lies far out in the margin of the cell giving it the appearance of a signet ring. Diagnosis: Krukenberg's tumor of the ovary."

There was considerable nausea and vomiting during convalescence after operation; the patient gradually lost weight and died on June 16, 1925. There is no record of an autopsy.

The second case, Mrs. A. H., was first seen by the writer April 22, 1927. She was aged 43 years, had been married 9 years, was a nullipara, and came complaining of slightly increased fullness and slight tenderness in the lower abdomen. There was nothing unusual in the menstrual or marital history except that she had never been pregnant. The

Fig. 2. Case 1. J. B. Signet ring cells well shown with areas of degeneration.

gastro-intestinal history was negative except that for years the patient had occasionally, after meals, regurgitated a small amount of food, without nausea.

Examination was negative except for the pelvis. The positive points in the pelvic examination were as follows: the cervix was low in the vaginal vault; the uterus was of normal size and pressed firmly downward and forward by a large mass, apparently arising from the left adnexal region. This mass was about the size of a small cantaloupe, smooth in outline and only slightly tender. In the right adnexal region was a similar but smaller mass about the size of a large lemon.

The patient was operated upon April 27, 1927. A moderate amount of straw colored fluid was found free in the abdomen. A smooth, regular non-adherent tumor of the left ovary and a similar tumor of the right ovary were removed together with the tubes. No other pathological process was found in the pelvis or abdomen, although the stomach itself was not explored.

The patient made a recovery which was uneventful except that moderate vomiting without nausea persisted for one week after operation.

The laboratory examination made by Dr. Roy Hammack definitely established the ovarian tumors to be Krukenberg carcinoma. His microscopic report is as follows: "The greater portion of the tissue is fibrous. Occasional definite ovarian structures, corpora fibrosa are found. Scattered through the fibrous tissue are epithelial structures of different types. There are a few alveoli with lumina and also solid alveoli. In some areas the cells are scattered through the fibrous tissue without definite arrangement. The most striking type of cell is one which is

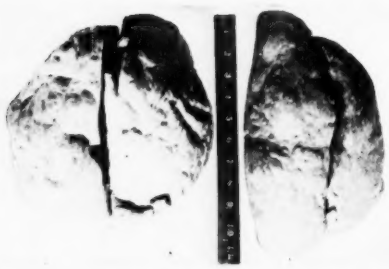

Fig. 3. Case 2. A. H. Note smooth surface, free of adhesions.

distended by a vacuole until only a thin rim of cytoplasm remains. On one side is the elongated flattened nucleus. Such cells form a comparatively small proportion of those present. Mitotic figures are common. The connective tissue is very cellular in some areas and even appears sarcomatous. In the œdematous area the epithelial cells are less diffusely scattered and occur in small compact groups."

A complete fluoroscopic and X-ray examination of the gastro-intestinal tract was made before the patient left the hospital and except for occasional fleeting attacks of nausea there were no digestive disturbances. On July 9, because of a rapidly increasing, irregular, general enlargement of the left breast, this breast was removed. Frozen section made at the table was negative, but on serial section many isolated areas of Krukenberg cells were found.

Shortly afterward this patient left Los Angeles and it was impossible to keep her under direct observation although reports were received from time to time. On January 27, 1928, she died of general carcinomatosis. The physician sending the report stated that there was considerable ascites and an apparent involvement of the lungs, some skin nodules over the upper abdomen, and a small recurrance in the pelvis, although it could not be ascertained what organ was involved in this recurrance.

Although, unfortunately, it was impossible to obtain autopsies on either of the cases reported, it seems highly probable that in the first case the gastric hæmorrhages and the indurated area in the stomach which was palpated at operation indicated that the growth was a typical one with the primary tumor in the stomach. In the second case, although no examination of the stomach was made at operation, and although fluoroscopic examination and X-ray gastric-intestinal analysis were negative, there was a history of vomiting, and a primary growth in the

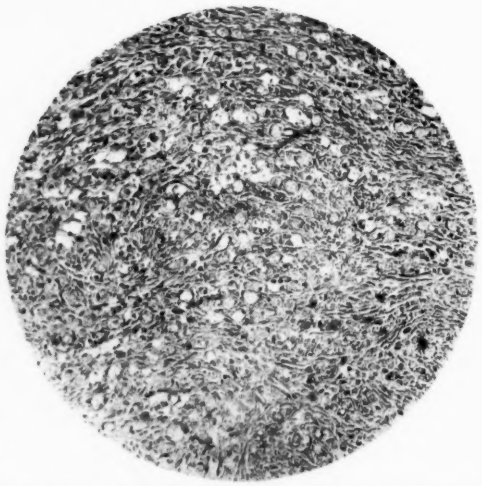

Fig. 4. Case 2. A. H. Relation of carcinomatous and sarcomatous elements well illustrated. Note large mucinous cells with eccentrically placed nuclei.

stomach or intestines certainly could not be ruled out without a careful autopsy report. It is quite possible in this case that the breast tumor was the primary growth although the fact that the Krukenberg cells were scattered in isolated areas through it would lend some weight to the theory that it also was a secondary growth.

The original conception of Krukenberg that these tumors are primary has been pretty well refuted by the more recent writers on the subject. Bell states that Krukenberg tumors are now invariably regarded as secondary to gastric carcinoma. However, there appear to have been a few authentic cases of growth primary in the ovaries and also a few primary in other organs such as the breast.

The fact that they are primary carcinomata rather than, as Krukenberg first believed, sarcomata, has now become quite generally accepted. It has been suggested by Shaw that ovaries in the childbearing periods afford an excellent culture medium for carcinoma cells and that the connective tissue of their stroma can react in an extraordinary embryonic manner to the presence of carcinoma cells in its neighborhood—an adequate explanation for the presence of the secondary stroma sarcomatous elements in these tumors.

Of special interest is the path of transmission of these tumor cells from the primary growth in the gastro-intestinal tract to the ovaries, and many theories have been advanced concerning the method of metastasis. Surface infection may be the process in some cases, and Major's case in which the typical Krukenberg cells were found in the pulmonic blood vessels certainly establishes the possibility of the hæmatogenous route, but there is much evidence to make the lymphatic route suggested by Amann the most plausible one. This theory presumes that the retrogastric and superior lumbar glands are invaded, thus producing a blockage of the lymphatic stream and as a result there is a retrograde migration by way of the ovarian lymphatics. Weight is added to this hypothesis in the shape of these secondary tumors which, even when quite large, almost invariably conform to the original form of the ovary, as though the invasion were through the medulla rather than the cortex.

SUMMARY

In conclusion, a résumé of our knowledge concerning these rare tumors is as follows:

1. Krukenberg tumors are essentially a form of carcinoma identified by large mucinous cells often with eccentrically placed nuclei.

2. They are almost, if not quite, invariably secondary to carcinoma elsewhere and usually to that in the gastro-intestinal tract.

3. They metastasize early and are almost invariably fatal.

4. They are usually bilateral.

5. They grow in a way to produce a general enlargement of the ovary which keeps its general form and is usually free of adhesions.

6. Ascites is usually associated with the tumors.

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OVARIAN TRANSPLANTATION

With the Report of Thirty-one Cases

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THE importance of the maintenance of the ovarian function is well recognized. A bilateral oophorectomy is sometimes necessary on account of advanced ovarian disease, and when this occurs during the childbearing period, a proportion of patients suffer as much, or more, from the surgical menopause as from their original condition. Women vary markedly in their reaction to oophorectomy, some suffer little, if any, inconvenience, others go through a moderately severe menopausal change, and in a definite proportion the nervous symptoms are marked and persist for a long period. As a general rule younger patients suffer more, but this is by no means always the case. The temperament of the patient is a better guide than the age. Some of the most severe incidents of the surgical menopause occur in women over 35 or 40 years of age. The nervous, highly developed, neurotic, married individual is prone to suffer most.

In the surgical menopause, the onset is more abrupt and the symptoms generally somewhat more severe than in the normal menopause. The duration is often somewhat shorter, but no definite prognostication can be made. The fact that a definite proportion of women suffer considerably from the artificial menopause, and that no positive rule can be formulated regarding the degree of discomfort in the individual case, should lead the surgeon to ovarian conservation whenever this can be safely carried out. On the other hand, the conservation of an ovary which will give subsequent trouble is generally worse than are the menopausal symptoms incident to its removal. It is in the latter group of cases that ovarian transplantation, or grafts, are valuable. It seems to be a fact that ovaries function more satisfactorily when the uterus can be preserved, but even in the absence of the uterus the ovarian hormone is elaborated and ovarian conservation is distinctly desirable. As a general principle, the ovary functions better in its normal position than in any other, and for this reason, ovarian conservation should be practiced when this is possible and transplantation, or grafting, reserved for those cases in which this is inadvisable.

Cases are not infrequently encountered in which the removal of one ovary is imperative, and the remaining ovary is so injured, or its blood supply impaired, that its conservation in its normal position is accompanied by considerable risk of subsequent degeneration, nonfunction, and the development of painful symptoms. It is in this type of case that transplantation by the Blair-Bell method has been practiced in the accompanying series. This series includes only patients in the childbearing age, and only those in whom autotransplantation has been practiced. Ovaries, the seat of neoplasms, have not been utilized. Ovaries containing large retention cysts which have been considerably torn during the course of the operation have frequently been pared down and a portion employed for the graft. Practically all the cases herein recorded were suffering from pelvic inflammatory disease. Operation is not resorted to during the acute stage of this disease and as a result most of the ovaries were presumably sterile. A further safeguard is that the graft is made in the rectus muscle and is therefore extraperitoneal and not likely to cause serious trouble even if infection should be present.

In our earlier cases the technique suggested by Blair-Bell was closely followed. In our later cases the ovary, after being decapsulated and scored, is divided into 2, 3, 4, or more portions, according to the amount of tissue available, and each is embedded in a separate pocket. As the grafts are smaller, this seems to result in a better blood supply for each; multiple cysts are less likely to form, and in general a higher percentage of "takes" apparently occurs. In some instances, only a small portion of an ovary has been available and this has frequently been utilized. Small

grafts not more than 8 millimeters in diameter and considerably less than this in thickness in our experience have been the most satisfactory.

TECHNIQUE

As soon as the ovary is removed it is attached to a suture and is placed in the cul-de-sac or among the coils of intestine in such a position that it will be kept warm and moist. The suture is employed in order that the ovary may be readily located. The intraperitoneal work is completed and the peritoneum is closed in the usual manner except for a small opening through which the ovary is withdrawn by means of the suture. The remainder of the peritoneal wound is closed by an assistant. Immediately upon the withdrawal from the peritoneal cavity the ovary is placed upon a hard surface and decapsulated. An extremely sharp knife facilitates this procedure. Care should be used to make decapsulation complete but not to sacrifice more ovarian tissue than absolutely necessary.

The decapsulated ovary is then freely and deeply scored. It is divided into pieces, none of which are more than 6 or 8 millimeters in diameter, or more than 3 or 4 millimeters in thickness. The fat is dissected away from the aponeurosis of the rectus, and an incision is made through the latter. This incision should be just large enough to permit the passage of the graft. With the handle of the knife, or a hæmostat, the fibers of the rectus muscle are gently separated and the graft is inserted. The graft should be completely surrounded by the muscle and not placed between the muscle and fascia. Care must be exercised in separating the fibers of the rectus not to produce bleeding. If a hæmatoma forms, the chances of a "take" are greatly diminished. If the separation of the muscle causes bleeding it is better to check the bleeding, close the aponeurosis, and make a new bed for the graft rather than employ one which is oozing. After the graft is placed in the muscle, the small opening in the aponeurosis of the rectus is closed by one or more fine catgut sutures. The above procedure is repeated for each graft. The remainder of the laparotomy wound is then closed in the usual manner.

We have not attempted grafting when drainage has been necessary. If grafts are to be employed in a case in which drainage is advisable, the ovarian tissue should be embedded in the wound as far as possible from the drainage tract. Strict asepsis and hæmostasis are essential for the success of the grafts.

The operation should not increase the mortality, and beyond adding a few minutes to the length of anæsthesia should not result in complications.

The disadvantages of this form of graft are: (a) the presence of the graft makes primary healing slightly less likely, (b) if infection of the wound occurs the graft may not "take," (c) the graft may not "take" because of the presence of a small hæmatoma or some other reason. The more remote complications are (d) the life of the graft is probably limited to 2 or 3 years, (e) retention cysts may develop in the graft causing pain and requiring evacuation, or removal of the ovarian tissue. (f) Even without a demonstrable enlargement of the graft, it not infrequently becomes tender for a day or two at monthly, or irregular, intervals. These periods are probably caused by the development of a graafian follicle. If the graft "takes" but insufficient ovarian tissue is present to prevent the development of the menopausal symptoms, the latter are prone to continue over a longer period than if bilateral oophorectomy alone had been performed.

It was with the hope of further reducing the incidence of these complications that the modification of the original method was attempted. In our experience the smaller multiple grafts seem to have functioned as satsifactorily as have the larger grafts, and have reduced the proportion of cases in which the grafts became tender. On theoretic grounds, it would seem that small grafts should become vascularized more quickly, that the proportion of "takes" should be greater, and the likelihood of the development of multiple retention cysts which might require removal should be lessened.

ADVANTAGES

The advantages of this form of ovarian transplantation are: (a) that complications rarely develop. (b) If they do they are of

minor importance and can easily be rectified by removal of the graft under local anæsthesia, or a few inhalations of nitrous oxide gas, and do not involve a major operation. This is not the case with intraperitoneal grafts and is an important point. (c) This form of graft is not a substitute for the conservation of the ovary in its normal position. It is applicable to cases in which conservation is not possible and may be utilized even when only a small portion of the ovary is available. (d) The grafts usually "take." (e) The sudden development of the menopause is generally averted, and when it occurs is more analogous to the normal than if the grafting had not been performed.

RESULTS

This series consists of 31 cases, among which there was no mortality. The after histories of 25 of these cases have been secured. These vary from 6 months to 3½ years since the time of the operation. Nearly all have been examined personally by one of the authors. Among the 31 cases there were two small stitch abscesses in one; in the remaining cases the wounds healed *per primam*. All the wounds are strong and no hernias have developed. The patients ranged from 21 to 39 years, the average age being 29.1 years. Bilateral salpingo-oophorectomy was performed in all cases, except one. In this case the left tube and ovary had been removed 10 years before the right salpingo-oophorectomy which was performed in our clinic. As far as can be determined, all of the ovarian tissue was removed in each case. In all the cases, pelvic inflammatory disease was present and in some was associated with uterine myomata. In the majority of cases, the pelvic inflammatory disease was extensive. In the milder cases of pelvic inflammatory disease, which require operation, it is generally possible to conserve an ovary in its normal position. Ovarian grafting was reserved for those cases in which this was impossible. There were 6 cases in which the uterus was conserved. All of these have menstruated regularly. They vary from 9 to 17 months since operation, the average period being 12.25 months.

When the menopausal symptoms develop after a hysterectomy, it is somewhat difficult to grade its severity properly. As the technique of grafting is the same when the uterus is conserved, the latter cases would seem to be an excellent guide regarding the proportion of "takes" which occur.

Whereas the above series is too small from which to draw accurate conclusions, it would indicate that a high percentage of the grafts functionate. There is usually a period of amenorrhœa lasting from 2 to 7 months following the operation, which probably corresponds to the time required to establish the circulation in the graft and for the latter to resume its power of functioning. The first menstrual period in one case was prolonged and profuse. After re-establishment of the flow, the periods were regular and normal. The 19 cases in which hysterectomies were performed showed the following results:

Menopausal symptoms	Cases	Percentage
Severe	2	10.5
Moderate	5	26.3
Mild	4	21.
Absent	8	42.1

In this series the period since operation varies from 3 months to 3½ years, the average being 16.2 months.

For a few months following operation the symptoms are often similar to those which would be expected if the grafting had not been performed. In some of our cases definite menopausal symptoms of flushing, nervousness, etc. have developed. In a few months these disappeared, and the patient has undergone all the manifestations of menstruation except the actual bleeding. It is not uncommon for these patients to state that they felt as if they were going to menstruate, or to ask why they do not bleed when they have all the premonitory symptoms. As none of our cases has been operated upon more than 3½ years, we are unable to state the duration of the life of a graft by this method. None has required a second operation so that results of histological studies of the transplants are not available.

As has been stated, it is extremely difficult to classify the severity of menopausal symptoms in general and especially those which follow surgical intervention. As a possible means of comparison for the results previously recorded in the cases which have been treated

by transplantation the following figures are submitted. (Table I)

The figures in Table I are arbitrary and would probably vary with different series. We do not believe that bilateral salpingo-oophorectomy, conservation of the uterus, and ovarian transplantations will in a large series give better results as far as the absence of menopausal symptoms are concerned than will unilateral salpingo-oophorectomy. The only advantage of the latter is that if the transplant requires subsequent removal this can be performed with less risk to the patient than can the removal of an offending ovary within the peritoneal cavity. There is every reason to believe that other things being equal an ovary will function more satisfactorily in its normal situation than in any other.

Unterberger engrafted discs of ovarian tissue into the rectus muscle. A period of amenorrhœa lasting 2 to 7 months occurred, which was followed in the majority of cases by regular menstruation. In young women the menses continued for 5 years, but when the women were over 40 the menopause soon developed. Kross believes that young tissue is more suitable for grafting. Cramer found that menstruation occurred in 18 of 19 cases in which the uterus was preserved and that menopausal symptoms were absent in 30 of 37 cases in which hysterectomy was performed. Transplantation was performed into the space of Retzius. Bell studied the results in 67 cases. In 57 the uterus was preserved. In this group menstruation occurred in 38, there were no menstruation and no menopausal symptoms in 9, menopausal symptoms were present in 9. In 10 cases hysterectomy was performed, of these menopausal symptoms were present in 3 and absent in 7. Bell believes that transplantation is contra-indicated in women over 42 years of age and in those who are sexually inactive. He found menorrhagia not unusual for several months during the re-establishment of the menstrual function. Bell employs ovarian and thyroid extract after operation and believes that this treatment relieves the menopausal symptoms until menstruation reappears.

Lack records benign cystic degeneration in transplants and Bell records 2 such cases among 150 grafts. Hallauer believes that autotransplanted ovaries retain their vitality for 2 or 3 years and often longer.

Sippel states that autotransplantation is indicated in young women of sexual maturity in whom bilateral adnexal disease has necessitated the removal of both ovaries and tubes. By this operation the worst symptoms of the artificial menopause are avoided, and ovarian function is preserved. This author reports the results in 9 cases; in 7 the result was successful. Premenstrual changes were observed in the endometrium in 3 cases. Both the unsuccessful cases were over 40 years of age. Schultze reports 9 cases of which 8 were successful.

TABLE I.—A COMPARISON BETWEEN THE RESULTS SECURED WITH AND WITHOUT OVARIAN TRANSPLANTATIONS.

	Menopausal Symptoms			
	Absent	Mild	Moderate	Severe
Hysterectomy and bilateral salpingo-oophorectomy 1682 cases. (Payne and Priestley)*	28%	72%	Present not graded	
Hysterectomy and bilateral salpingo-oophorectomy (Steinhardt)†	14%	25%	39%	21.7%
Hysterectomy and bilateral salpingo-oophorectomy and ovarian transplantation. (Norris and Behney)	42%	21%	26.3%	10.5%
Unilateral salpingo-oophorectomy. (Payne and Priestley)*	80%	20%	Present not graded	
Bilateral salpingo-oophorectomy and ovarian transplantation. (Norris and Behney)	100%			

*Payne, F. L., and Priestley, J. University of Pennsylvania,—from a study of end-results, which paper was read at the May, 1929, meeting of the Philadelphia Obstetrical Society.
†Steinhardt, B. Ztschr. f. Geburtsh. u. Gynaek., 1927, xci, 361.

CONCLUSIONS

1. Ovarian transplantation is not a substitute for conservation of the ovary in its normal situation and should be reserved for those cases in which this is inadvisable.

2. The life of the transplanted ovary is probably not more than 2 or 3 years.

3. Grafts frequently become tender for a day or two each month. They rarely give serious trouble.

4. The operation is practically without mortality or morbidity.

5. Most of the grafts "take."

6. When the menopause occurs it is generally more prolonged, gradual, and analogous to the normal menopause than if grafting had not been performed.

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SALPINGITIS

A Detailed Analysis Based on the Study of Five Hundred Forty-five Cases—January, 1914 to December, 1927, Inclusive[1]

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IT will become evident that the diagnosis, differential diagnosis, and proper treatment of salpingitis comprise a very important portion of modern surgery, not only for the gynecologist but for the general surgeon. It will also be evident that salpingitis is a definite clinical entity, and although it simulates and is simulated by other conditions, there are many characteristic features.

CLASSIFICATIONS

There are many classifications, such as those referring to that portion of the tube involved: interstitial, parenchymatous, mural, and so forth; those that refer to the pathological etiology, such as purulent, gonorrhœal, tuberculous, staphylococcal, and other forms. However, in this study the types of cases will be referred to under the following classifications, it being considered the most practical clinically: (1) acute, (2) acute exacerbation,[2] (3) chronic, and (4) tuberculous.

Of the 545 cases, 115 were acute, making 21.1 per cent; 114 were acute exacerbation or 20.9 per cent; 293 were chronic or 53.7 per cent; and 26 or 4.7 per cent, were tuberculous.

AGE

The disease occurred in persons as young as 11 and as old as 60 years. The average age was 28.7 years.

Four patients were under 16 years of age, namely, 11, 12, 13, and 15 years. Three of these patients had never menstruated. It is a well known fact that gonorrhœal vulvitis and vulvo vaginitis are rather frequent in children, sometimes being epidemic in nature. None of these 4 cases, however, gave the history as being of that type. It is probably rare that the form of gonorrhœal vulvovaginitis usually seen in little girls extends upward, causing salpingitis. It is possibly true that salpingitis is caused by gonorrhœal infection introduced by sexual intercourse only. There are, however, a few exceptional cases.

There were 95 young women in our series between the ages of 16 and 21, inclusive; 6 of them were 16 years old, 7 were 17, 9 were 18, 24 were 19, 24 were 20, and 25 were 21 years of age.

The ages of the *acute* cases varied between 11 and 60 years, the average being 25.8 years.

The ages of the *acute exacerbations* varied between 17 and 51 years, the average being 30.4 years.

The youngest *chronic* case was 16 years, the oldest 50, the average being 29.5 years.

The youngest *tuberculous* case was 20 and the oldest 40 years, the average being 26 years.

The deduction to be drawn from this study of ages is that age alone plays little part in the determination of the type or incidence of the disease.

MARITAL

Four hundred and twenty of the patients were married, 83 were single, 37 were widowed, and 5 were divorced. According to these figures only 15.2 per cent of the women had not been married. This may or may not be accurate, depending on the honesty of the patients.

OCCUPATIONS

Sixty-two histories failed to give the record of any occupation. It would be interesting to know what proportion of women with salpingitis are or have been prostitutes. It was impossible to obtain any information on that subject, as the internes who took the histories were either unable to elicit such data or were reticent in recording it.

[2] The term "acute exacerbation" is generally used in reference to a chronic disease in which a sudden flaring up of the infection occurs. It is used more as a separate entity, here, because there is such a great difference between most of the chronic cases and the acute exacerbations. The determination of the acute exacerbation was in many cases pathological and not because the patient gave the history of a chronic salpingitis. Most of the histories of acute exacerbations simulated those of the acute cases.

[1] Read before the Surgical Section of the New York Academy of Medicine, November 2, 1928.

Three hundred eight women were housewives or were occupied in doing housework. Fifty-nine were domestic servants, such as cooks, chamber-maids, waitresses, hat check girls, etc. Thirty-six were factory workers, ten were saleswomen, ten were actresses or professional dancers, and nine were telephone operators. There were also seven dressmakers, seven stenographers, six clerks, five embroiderers, four schoolgirls, four school teachers, four milliners, two bookkeepers, two manicurists, two needle workers, two corset fitters, two cashiers, two designers, and one social worker.

Thus, no conclusions can be drawn from these occupational statistics.

LEUCOCYTOSIS

The statistics given below refer to the leucocytosis present within a few hours or during the first day of admission to the hospital. Subsequent counts varied according to the type and progress of the case, virulence of infection, and resistance of patient.

All cases. The general average count in all cases was 14,589 leucocytes with 79.6 per cent polymorphonuclears. The highest count was 45,300 and the lowest 4,400. The highest percentage of polymorphonuclears was 98 and the lowest 34.

Acute cases. The highest leucocytosis in the acute types was 45,300, the lowest 6,900, the average being 16,790. The highest percentage of polymorphonuclears was 98, the lowest 61, the average being 84.2.

Acute exacerbation cases. The highest leucocytosis in acute exacerbations was 36,000, the lowest 8,000, the average being 16,875. The highest percentage of polymorphonuclears was 95, the lowest 64, the average being 82.8.

Chronic cases. The highest leucocytosis in the chronic form was 28,400, the lowest 4,400, the average being 11,087. The highest percentage of polymorphonuclears was 90, the lowest 34, the average being 73.5.

Tuberculous cases. The highest leucocytosis in the tuberculous form was 23,000, the lowest 6,000, the average being 12,580. The highest percentage of polymorphonuclears was 88, the lowest 67, the average being 78.7.

One of the deductions from this study is that leucocytosis is present in practically all cases of salpingitis, even of the chronic and tuberculous types. Another deduction is that the leucocytosis is relatively higher than the temperature—there usually being a leucocytosis even without pyrexia. This would not be found in a similar study of appendicitis. It is safe to state, then, that the leucocytosis of salpingitis is consistently higher than that of appendicitis. The relative polymorphonuclear count is high in all forms; this fact is of special interest in the tuberculous variety where it might not be expected.

FEVER

The relation of fever to salpingitis refers only to the temperature on admission to the hospital. The highest temperature was 105.2 degrees, the lowest 97.6, and the average 99.5.

Acute cases. The highest temperature was 105.2 degrees, lowest 98, the average 101.32.

Acute exacerbation cases. The highest temperature was 104 degrees, the lowest 98.4, and the average 101.08.

Chronic cases. The highest temperature was 101.3 degrees, the lowest 97.6, and the average 98.12.

Tuberculous cases. The highest temperature was 104.1 degrees, the lowest 98, and the average 100.

As has been previously stated under "Leucocytosis," the leucocyte count is usually relatively higher than the rise in temperature. Notwithstanding this, there is a constant pyrexia in practically all cases of salpingitis, which is no doubt higher than would be found in a similar appendicitis series. An elevation of temperature of 101.32 degrees would be high for an acute appendicitis, but it is only the average for this series of acute salpingitis. This is contrary to some textbook teachings.

HISTORY, SYMPTOMS, AND PHYSICAL SIGNS

The history of previous attacks of salpingitis varied from 2 weeks to 15 years, the average remote onset being 4½ months before admission to the hospital.

The duration of the present illness varied between a few hours and 3 months, the average time being 12½ days before admission.

The important complaints in the histories were: nausea alone (without vomiting) in 58 or 10.6 per cent of cases; nausea with vomiting in 179 or 32.8 per cent of cases. Thus, 237, or 43.4 per cent of the patients, complained of either nausea or vomiting or both.

Indigestion in 53 or 9.7 per cent. The term indigestion refers to the complaints of heaviness in the epigastrium, heartburn, gastric distention, and the belching of gas and sour material. As this syndrome was so prevalent, it suggests a comparison between the digestive disturbances of appendicitis and upper abdominal diseases. The digestive complaints in these 53 salpingitis cases simulated those of upper abdominal disease, such as peptic ulcer or cholecystitis, rather than of appendicitis.

Headache in 76 or 13.9 per cent. There is evidently some peculiar association between salpingitis and headache, it probably not being due to fever alone, because it occurred many times when there was little or no fever. In some of these, headache was the chief complaint. This is possibly an ovarian reflex similar to the headache occurring with menstruation.

Dysuria in 100 or 18.3 per cent and urinary frequency in 68 or 12.4 per cent: These two complaints have commonly been considered cardinal symptoms of salpingitis. However, their incidence appears relatively small.

Gonorrhœal history in 16 or 2.9 per cent: Almost invariably was blamed on the husband.

Vaginal discharge in 348 or 63.8 per cent: This, although it was either elicited in the history or found on examination, was usually a complaint. In many cases there was no foul yellowish discharge—only a complaint of leucorrhœa. This manifestation has also been considered as pathognomonic of salpingitis. However, 36.2 per cent gave no history or manifestation of vaginal discharge.

Dysmenorrhœa in 122 or 22.3 per cent: Dysmenorrhœa is not of as great importance as it is usually considered. It was only present in 22.3 per cent of cases, many of which had other pelvic diseases that might have been the cause of the dysmenorrhœa.

Irregular menstruation in 171 or 31.3 per cent.

Location of the complaint of pain: Both lower abdominal quadrants in 261 or 47.8 per cent of cases; right lower quadrant in 170 or 31.1 per cent; left lower quadrant in 94 or 17.2 per cent; back in 174 or 31.9 per cent.

Epigastrium in 24 or 4.4 per cent: Only 4.4 per cent of the patients complained of pain in the epigastrium, in differentiation from appendicitis, in which it is a well established fact that the majority of patients complain of pain in the epigastrium, at least during the onset of the attack. Also, in appendicitis, after the pain arises in the epigastrium, it soon radiates to the lower right quadrant; while in salpingitis, if the pain is in the epigastrium, it usually remains there without any radiation.

Other locations of pain were: Shoulder in 13 or 2.3 per cent; thigh in 31 or 5.6 per cent; leg or legs in 27 or 4.9 per cent; genitalia in 7 cases; rectum in 4; breast in 2; axilla in 1; arms in 2; precordium in 2; upper right abdominal quadrant in 4; chest in 7; groin in 4; midabdomen in 2.

Other factors: Vaginal bleeding in 43 cases, chills in 74, complaint of fever in 73, sweats in 9, menorrhagia in 9, metrorrhagia in 11, salpingitis symptoms after the menopause in 3, before menstruation in 3, during pregnancy in 3, and associated with syphilis in 9.

Onset of attack of salpingitis was preceded by the following: Miscarriage in 36 cases; delivery in 36 cases (these together make 72 or 13.2 per cent of the cases which may be considered of puerperal origin. It was impossible to determine whether or not there was gonorrhœa).

By vaginal examination, masses were found in 207 or 37.9 per cent of the patients. The locations of the masses were: both lateral fornices in 46 or 8.4 per cent of cases; right fornix in 82 or 15 per cent; left fornix in 62 or 11.3 per cent; posterior fornix or cul-de-sac in 36 or 6.6 per cent.

Other physical findings were: Abdominal distention was mentioned only 9 times; abdominal masses were found in 46 or 8.4 per cent of cases, which is low compared with the number of vaginal masses found, but shows that they are found abdominally in an appreciable number; retroversion in 27; negative

examination in 23 (in these cases the diagnosis was made on the history alone, usually that of repeated attacks); tender cervix in 20; thickened fornices not sufficient to call a mass in 30; retroflexion in 3; enlarged inguinal lymph nodes in 1; acute urethritis in 1; enlarged uterus in 8; tender uterus in 6; fixation of the cervix in 3; laceration of the cervix in 2; hæmaturia in 1; anteversion of the uterus in 1; tenderness in the flank in 1; jaundice in 1; prolapse of the uterus in 2; fixation of the uterus in 1; subinvolution of the uterus in 1; cystocele in 1; labial herpes in 1; lump in the vagina in 1.

DIAGNOSIS

An accurate history is often impossible as this type of patient is frequently untrustworthy or ignorant, thus necessitating considerable care in the eliciting of data. It is, therefore, important that care be used to obtain a very accurate and complete history and to make a thorough physical examination in salpingitis in order not to make mistakes in diagnosis, because there are many conditions simulating it. Doubtless, in this series, the cases were well studied and judged with discretion, but these determinations were not always incorporated in the records. Therefore, while some of the records appeared to show carelessness, indefiniteness or incompleteness in history taking—several mistakes actually being made, such as incorrect diagnoses, or operating at wrong time or without proper indications, or diagnosing complications but missing the salpingitis—this may have been only apparent. Whether or not there was any carelessness, emphasis is laid on the great importance of care, thoroughness, and accuracy, because salpingitis is by no means to be treated routinely or without deliberation.

Two hundred ninety-five or 54.1 per cent of cases were quite definite and easily diagnosed; 72 or 13.2 per cent were fairly easy to diagnose; 25 or 4.58 per cent were indefinite—the diagnosis not being certain; 76 or 13.8 per cent were difficult to diagnose; 39 or 7.1 per cent were either carelessly or wrongly diagnosed or else their case histories were indefinite and incomplete and the physical examinations were lacking in details.

MISTAKES IN DIAGNOSIS

In 388 or 69.6 per cent of cases, salpingitis was correctly diagnosed. In 16 or 2.8 per cent, no diagnosis was made before operation, the postoperative diagnosis being salpingitis. The remaining cases, 103 or 27.4 per cent, were wrongly diagnosed and were operated upon with the following diagnoses, the postoperative being salpingitis: Appendicitis in 53 cases; retroversion of the uterus in 18; ectopic gestation in 15; cystic ovary in 15; salpingitis was diagnosed, but not tuberculous salpingitis, in 13 cases which turned out to be tuberculous; tuberculosis of the fallopian tubes is considered a separate disease entity, but it is worthy of note that M. Salmond reports a case of tuberculous salpingitis associated with acute gonorrhœa; fibromyoma of the uterus in 12; laceration of the cervix in 3; intestinal obstruction in 2; prolapse of the uterus in 2; abdominal adhesions in 2; incomplete abortion in 2; cyst of the broad ligament in 2; pregnancy in 1; ruptured peptic ulcer in 1; gastric ulcer in 1; acute cholecystitis in 1; cholelithiasis in 1; general peritonitis in 1; pelvic tumor, unclassified, in 1; endometritis in 1; metrorrhagia in 1; menorrhagia in 1; carcinoma of the uterus in 1; pelvic cellulitis in 1; typhoid fever in 1.

It is probably untrue that this large proportion was wrongly diagnosed; the records are in many instances quite vague in this regard. For years no pre-operative diagnosis was made, that is, there was none recorded. However, this shows that wrong diagnoses often occur, and are not infrequently of considerable importance.

DIFFERENTIAL DIAGNOSIS

It was necessary to consider the following conditions in the differential diagnosis. Many of them were found to be present as complications. All of them caused symptoms and signs which simulated in some way those of salpingitis. The conditions that were actually present as complications will be again taken up under the heading "Complications."

1. In 103 or 18.8 per cent of cases, appendicitis in many of its forms (acute, chronic, ruptured, appendiceal abscess, etc.); ectopic gestation, right or left, ruptured or unrup-

TABLE I.—DIFFERENTIAL DIAGNOSIS

Diagnostic factors	Salpingitis	Appendicitis	Ectopic pregnancy	Cystoma of ovary	Fibroid uterus	Retroversion of uterus	Chronic endometritis	Ureteral colic
Previous attacks	Likely	Possibly	None	Likely	None	Indefinite	Indefinite	Likely.
Temperature elevation	Usually higher than in appendicitis	Usually	Slight	None	None	None	Usually none	None.
Leucocytosis	Present, higher than in appendicitis	Present	Very slight	None	None	None	Usually none	None.
Nausea	Often present continuously	Often present early	Morning	Often present	None	Occasionally present	None	Usually present.
Vomiting	Often present	Often present	Usually none	Usually none	None	Occasionally present	None	Occasionally present.
Indigestion	Ulcer type	Nausea and vomiting	Early pregnancy type	Nausea	None	Usually none	None	None.
Headache	Often present	None	None	Occasionally present	None	Occasionally present	None	None.
Dysuria	Often present	None	None	None	Often present, 25 per cent	Often present	None	Present.
Urinary frequency	Often present	None	None	None	Often present, 25 per cent	Often present	None	Present.
Vaginal discharge	Usually present	None	Bloody "spotting"	Usually none	Usually with menstruation	Leucorrhœa	Persistent leucorrhœa	None.
Irregular menstruation	Usually present	None	Present	Present	Menorrhagia	Prolonged menstruation	None	None.
Dysmenorrhœa	Usually present	None	None	Present premenstrual	Usually none	Present	Present	None.
Location of pain	Bilateral L. or R. L. Q.	Epigastrium and L. R. Q.	Unilateral	Unilateral or bilateral	Pressure pains	Backache	Indefinite	Course of ureter.
Tenderness	Usually bilateral	Left lower quadrant	Slight unilateral	Unilateral or bilateral	Non-tender mass	None	Slight abdominal	Unilateral abdominal.
Rigidity	Bilateral L. or R. L. Q.	Left lower quadrant	None	None	None	None	None	Unilateral abdominal.
Vaginal examination	Bilateral, tender or mass	High r. tend. No mass	Soft mass unilateral	Ovary or cyst palpable and tender	Hard mass non-tender	Cervix forward, uterus backward	Indefinite	Negative.
Vaginal bleeding	Occasionally present	None	Present	None	Metrorrhagia	Menorrhagia	Menorrhagia	None.
Special								Hæmaturia. X-ray.

tured, in 40 or 7.3 per cent; cystoma of ovary, unilateral, bilateral, ruptured, or infected, in 37 or 6.7 per cent; carcinoma of the ovary in 1.

2. Uterine conditions were: Fibroid uterus in 34 or 6.2 per cent of cases; retroversion in 29 or 5.3 per cent; retroflexion in 3; anteversion in 1; anteflexion in 1; prolapse in 2; subinvolution in 1; double uterus in 1; infantile uterus in 1; endometritis, acute or chronic, in 26 or 4.7 per cent; pregnant uterus in 11; incomplete abortion in 5; ruptured uterus in 1; carcinoma of the uterus in 1; metrorrhagia in 1.

3. Extra-uterine conditions were: Cyst of the broad ligament in 5 cases; pelvic neoplasm, unclassified, in 4; parametritis in 1; pelvic hæmatoma in 1; pelvic cellulitis in 1.

4. Abdominal conditions were: Abdominal pregnancy in 1; abdominal adhesions in 6; acute diverticulitis in 4; acute or subacute intestinal obstruction in 3; general peritonitis in 3; tuberculous peritonitis in 1; pneumococcus peritonitis in 1; visceroptosis in 1; constipation in 2; gastro-enteritis in 2; intestinal parasites in 1; abdominal lymph nodes in 1.

5. Upper abdominal and urinary tract conditions were: Gastric ulcer in 7 cases; acute cholecystitis in 7; pleurisy in 1; pyelitis in 1; nephroptosis in 2; hydronephrosis in 1; ureteral colic in 3; cystitis in 1.

6. Conditions of the cervix were: Lacerations in 5; stenosis in 2; endocervicitis in 1; cystocele in 1.

7. Other general conditions were: Typhoid fever in 2; malarial fever in 1; septicæmia in 1; migraine in 1; neurasthenia in 1; alcohol poisoning in 1; sterility in 1; glandular dystrophy in 1; hæmorrhoids in 1.

A study of the foregoing cases indicates that the most important and the most frequent conditions to be differentiated are—in order of their incidence—appendicitis, ectopic gestation, cystoma of ovary, fibromyoma of uterus, retroversion of uterus, endometritis, and ureteral colic, as shown in Table I.

The number of cases operated upon were: All Cases: 437 or 80.2 per cent of admissions; not operated on, 108 or 19.8 per cent. Acute: 79 or 69.3 per cent of admissions; not operated upon, 35 or 30.7 per cent. Acute exacerbations: 95 or 83.3 per cent of admissions; not operated on, 19 or 16.7. Chronic: 240 or 82.2 per cent of admissions; not operated on, 52 or 17.8 per cent. Tuberculous: 25 or 96 per cent of admissions; not operated upon, 1 or 4 per cent. Besides these, were 5 acute exacerbations and 21 chronic cases upon which operation was advised, but was refused.

The advisability of operation in some of the foregoing types will be considered later under the heading "When to Operate."

COMPLICATIONS

There were 89 or 16.3 per cent of uncomplicated cases, not including many in which the appendix was slightly involved in the process or chronically diseased—all of these being classed as complications.

There were 287 cases in which the appendix was involved, that is, involved at least in the operative procedure, not necessarily in the disease process; many being normal appendices which were removed as a prophylactic measure. Ten of the cases were classed as acute peri-appendicitis, that is, infection of the outer coats first by contiguity of tissue from the tubes. Many were chronically diseased, but very few were acute. One was tuberculous.

Ovarian disease was the next most common complication, there being 273 or 50.1 per cent of cases; 161 were considered as oophoritis, unilateral or bilateral; 103 as cystoma of the ovary; 1 as prolapse of the ovary; 5 as teratoma of the ovary; 3 as tuberculosis of the ovary.

1. Many conditions of, or involving, the uterus were found as complications: Endometritis in 74 cases, one of which was tuberculous; retroversion in 65; retroflexion in 2; fibromyoma in 24; bicornuate uterus in 1; metrorrhagia in 1; incomplete abortion in 4; unruptured ectopic pregnancy in 2; abscess of uterus in 1; cyst of uterus in 1; prolapse of uterus in 1; normal pregnancy in 3.

2. Other complications were: Lacerations of the cervix in 9; relaxation of the perineum in 9; erosion of cervix in 2; fibroma of cervix in 2; stenosis of cervix in 1; hypertrophy of cervix in 2; Bartholin's cyst in 2; perineal fistula in 1.

3. Among the extragenital abdominal complications were: Wound infection in 14 cases; intraligamentary cysts in 13; general peritonitis in 28, one of which was tuberculous; acute cholecystitis in 5; cholelithiasis in 2; perforation into cæcum in 2; ascaris lumbricoides in 1; trichinosis in 1; fæcal fistula in 7; peritoneal adhesions in 16; Meckel's diverticulum in 1; ventral hernia in 2; Lane's kink in 1; acute dilatation of the stomach in 1; gastroptosis in 1; acute intestinal obstruction in 1; abdominal sinus in 1; gastro-enteritis in 1; pancreatitis in 1; constipation in 1.

4. Urinary conditions as complications were: Cystitis in 2; pyelitis in 2; nephritis in 2; lacerated wound of ureter in 1; chronic urethritis in 1; nephrolithiasis in 1; nephroptosis in 1.

5. Pulmonary complications were: Pulmonary embolus in 2; lobar pneumonia in 2; bronchopneumonia in 2; bronchial asthma in 1; pulmonary tuberculosis in 4; pleurisy in 1; atelectasis in 1; lung abscess in 1.

6. Other general complications were: Syphilis in 12; chronic cardiac valvular disease in 4; hæmorrhoids in 3; ether narcosis causing death in 2; and one case each of the following: sterility, cerebral accident, epilepsy, constitutional psychopathy, anæmia, hæmatoma of back, goiter, phlebitis, inguinal lymphadenitis, aneurism of the aorta, hysteria, axillary abscess, and surgical shock.

Although diseases of the appendix, uterus, and ovaries are most often associated, the

foregoing study demonstrates that there are many other conditions which complicate salpingitis. The involvement of the appendix is mostly a matter to be concerned with in the differential diagnosis; the involvement of the ovaries is so frequent that it is practically considered with the pathology of the salpingitis. The involvement of the uterus is not only a large factor in the differential diagnosis but also in the prognosis. Due to the numerous and varied complications arising with salpingitis, it is often advisable to have consultations between the gynecologist and the general surgeon.

PREGNANCY

Pre-operative pregnancies. Of the 545 cases, 299 or 54.8 per cent had had pregnancies; 195 had had no pregnancies; and in 51 either the patient would not volunteer the information or that part of the history was neglected. Of the 299 women who had had pregnancies, there had been a total of 806 pregnancies, an average of 2.69 per patient; there were 443 children living and well, an average of 1.47 per patient; 93 children who had died, an average of 0.31; and 270 miscarriages, criminal abortions, premature labors, etc., an average of 0.90. Of the 26 tuberculous patients, 16 had had no pregnancies before operation; in 5 cases this history was not elicited; and 4 had had pregnancies, each having one child living and well, one having had one miscarriage, and one having had a child that died.

Postoperative pregnancies. There were 16 patients who reported pregnant: 1 patient came in definitely pregnant; 3 had had children who were living and well; 6 came in complaining of symptoms of early pregnancy and were probably pregnant; 4 were later admitted to the hospital and operated upon for ectopic pregnancy; 2 had miscarriages. In the tuberculous cases, no pregnancies were reported after operation.

That it is possible for pregnancy to occur after a large part of the adnexa has been removed and following infection of the tubes and ovaries, will be shown in the following reports of cases wherein the patient became pregnant after operation, it being left to the judgment of the reader as to whether or not some of them were actually pregnant:

1. Eight months after a right salpingo-oophorectomy and appendectomy for chronic salpingitis, the patient was readmitted and operated on for left tubal gestation.

2. Five months after bilateral salpingectomy and right oophorectomy, the patient complained of occasional pain in the back and lower abdomen, with amenorrhœa, and thought that she was pregnant.

3. One year after right salpingo-oophorectomy and freeing of adhesions, the patient had a normal pregnancy and delivery.

4. Three years after bilateral salpingectomy and appendectomy, the patient had a miscarriage.

5. Nine months after left salpingo-oophorectomy, appendectomy, and dilatation and currettage, the patient was definitely pregnant.

6. Four years after right salpingectomy and excision of cystoma of ovary and appendectomy, the patient was readmitted for left tubal gestation.

7. Two and one-half years after bilateral salpingectomy and left oophorectomy, the patient had a miscarriage.

8. Two years after bilateral salpingectomy, left oophorectomy, appendectomy, dilatation and currettage, and myomectomy, the patient was thought to be pregnant.

9. Seven and one-half months after left salpingectomy, the patient had a normal pregnancy and delivery.

10. Ten months after right salpingectomy, appendectomy, and dilatation and curretage, the patient was thought to be pregnant.

11. Three months after left salpingo-oophorectomy, appendectomy, and dilatation and currettage, the patient was thought to be pregnant.

Other cases on record were quite indefinite and may or may not have been pregnant.

OPERATIVE PATHOLOGY

Bilateral salpingectomy was done in 292 cases or 53.5 per cent; right salpingectomy was done in 63 or 11.5 per cent; left salpingectomy was done in 48 or 8.8 per cent.

Smears and cultures taken from the tubes were positive for gonococci in only seven instances; staphylococcus was found in two; and

streptococcus in one. The remaining cases in which smears were taken were sterile. In many, smears were not taken. According to Ricci, "Gonorrhœa of the fallopian tubes is a self-limiting disease. It produces but one attack of pain, fever, and leucocytosis—the initial one. When subsequent attacks occur and adnexal masses are palpable, the gonococcus has yielded its endosalpingeal habitat to secondary bacterial invasions."

Hydrosalpinx was found thirty times. By hydrosalpinx is meant the final stage in the chronic process in which absorption of the contents has gone on to such a degree that only a watery material remains, enclosed in a sac formed by the walls of the tube and its blocked extremities. The similar primary acute pathology such as is seen in hydrops of the gall bladder probably does not occur with the salpinges. Hæmatosalpinx, which is the acute hæmorrhagic form, was found three times. In these two classes of cases all smears and cultures were sterile.

Three hundred twenty-two or 74.5 per cent were closed without drainage. Most of them remained clean. Abdominal wall abscesses occurred in a few. In 89 or 20.5 per cent, abdominal drainage was used; in 22 or 5 per cent, vaginal drainage (posterior colpotomy).

A few words may be said here as to the advisability of drainage. Fewer cases are being drained now than in former years. This is a definite step in advance in the surgery of salpingitis. It is rarely found that a case that has not been drained should have been. This is probably due to the fact that the pus has become sterile. The infection has worn itself out. Therefore, it is only necessary to remove the pathological process, or as Miller (3) puts it, "The patient forms her own immunity." Thus, the percentage of negative cultures increases in direct ratio to the length of time the case has "cooled." Especially have the views on posterior colpotomy changed. It is now considered very seldom to be a good procedure, and is only indicated, without laparotomy, in cases presenting a huge well defined pelvic abscess. It is indicated after laparotomy, when much pelvic exudate is present.

Disease other than of the fallopian tubes. (1) Involvement of the ovaries: The right ovary was found to be diseased and was removed in 160 cases; the left also in 160. A partial oophorectomy was done in 42 cases. An attempt was made to save all of the ovarian tissue possible in order to prevent the onset of an artificial menopause. The proper procedure is to leave in all of the ovarian tissue that is not definitely grossly diseased. (2) Involvement of the appendix: Appendectomy was done in 287 cases, as will be subsequently described. (3) Other operations were: Dilatation and currettage in 71 cases for endometritis or retained secundines; hysterectomy in 29, either for infection or fibromyomata; myomectomy in 13; uterine suspension for retroversion in 52; freeing of adhesions in 11; excision of cyst of broad ligament in 2; replacement of prolapsed ovary in 2; excision of peritoneal cyst in 1; excision of cysts of the ovary in 2, in which the cysts contained grape-juice-like material typical of tuberculosis of the ovary; trachelorrhaphy in 4; perineorrhaphy in 6; repair of lacerations of the cervix in 1; excision of Bartholin's abscess in 1; amputation of the cervix in 1; excision of perineal fistula in 1; cholecystostomy in 1; cholecystectomy in 4; exploratory laparotomy finding no disease in 1; repair of perforations of the cæcum in 2; hæmorrhoidectomy in 1; freeing of Lane's kink in 1; bladder suspension in 1; incision and drainage of hæmatoma of back in 1; suture of lacerated wound of the ureter in 1; nephrectomy in 1; herniorrhaphy in 1.

WHEN TO OPERATE

The judgment of the surgeon in the individual case being of prime importance, rules cannot always be followed in surgery. However, it is well to have certain general views on the different types of cases. Some of the modern recognized views on the surgical indications of salpingitis are as follows:

1. Acute cases should never be operated upon. Of course, this rule has its exceptions, the most important of which is—doubt in diagnosis. The doubt is usually concerned with acute appendicitis. It certainly is far better to operate upon a few cases of salpingitis in the acute stage than to allow an acute appendix to rupture, with general peritonitis or even death as the result.

2. Even an acute fulminating salpingitis with general peritonitis should not be operated upon if the diagnosis is reasonably certain. In the New York Hospital series, these cases subsided without operation. Operation frequently causes spread of the peritonitis, resulting in death.

3. When there is a reasonable doubt between salpingitis and appendicitis in the acute form, operation should be advised, because there is too much danger in delaying or not operating upon an acute appendix.

4. When the abdomen is opened on another diagnosis and acute salpingitis is found, it is usually advisable to remove the tubes, except in young girls. This may seem reactionary, but experience teaches that if these acute tubes are removed, there are usually no untoward effects; on the other hand, however, if they are not removed and if they do subside, they are very liable to recur or become reinfected.

5. Patients, during an acute exacerbation, should not be operated upon, as an operation is very liable to spread the infection to the surrounding tissues and to the peritoneum. The exacerbation should be allowed to subside and the operation should not be performed until after the temperature has been normal for about 5 days. It is usually advisable to operate after the 5 days of normal temperature and while they are still in the hospital, for, if they are allowed to go home with instructions to return later for operation, they are too prone to wait until another exacerbation occurs, when the whole procedure would have to be repeated.

6. In chronic salpingitis, the tubes should be removed if they are not patent. If patent, removal is not advisable unless the tubes are definitely giving rise to symptoms.

7. Tubes in acute and acute exacerbation salpingitis of tuberculous nature should be allowed to subside. Chronic tuberculous tubes should not be operated upon until every other therapeutic measure has been given a fair trial.

8. All ovarian tissue not definitely grossly diseased should be left in. Partial oophorectomy was frequent in this series of cases.

Good judgment was shown in operating on 185 chronic cases. Of the acute variety, 48 were operated upon, which might have subsided. Theoretically, in the latter, it was incorrect to operate. In many of the cases, the tubes were removed, but in quite a few, after the mistake in diagnosis was recognized, the abdomen was closed without disturbing the tubes. In all of the latter cases, the inflammation subsided. Thirty-three which were operated upon during an acute exacerbation should have been allowed to subside. Correct procedure was followed in 16 cases of acute exacerbations, no operation being performed until the exacerbation had subsided. There were 48 cases of the acute variety which subsided without operation, the treatment consisting of rest in bed, ice bags, hot douches, etc. Fifty-nine were operated upon following other diagnoses, but as chronically diseased tubes were found, it proved to be the proper procedure. Forty-three were operated upon following other diagnoses and in many instances, either acute or acute exacerbation tubes were found and removed. Of the tuberculous variety, 19 were diagnosed chronic salpingitis, rather than tuberculous. These were operated upon—a theoretically incorrect procedure. Three tuberculous acute exacerbations were also incorrectly operated upon; one acute case was treated medically. Thirty-eight persons, most of them being chronic cases, were advised to have operative treatment, but refused.

There has been considerable controversy during the past few years as to the proper time of operation. The trend has definitely been toward conservatism ever since Simpson's article in 1909, in which he put forth his excellent principles of treatment. It is said that he reduced the death rate in a large series of cases from 20 per cent to 1 per cent by operating only upon quiescent cases, after 3 weeks or more of normal temperature and leucocyte count.

Miller, in his recent article, brings out some interesting observations from his study of 600 cases in the Charity Hospital and the Touro Infirmary of New Orleans. He found that in 381 of the 600 conservative treatment was not carried out; that is, they were operated upon in the presence of fever. He also found that 70 per cent with rest treatment alone

reached a permanent normal temperature in a week or 10 days.

Ricci advocates a waiting period of over 3 weeks, as he found that some cases operated upon even after the 3 weeks did poorly. He even goes so far as to say "Patients with pelvic masses harboring organisms of various types, the streptococcus included, may, from an economic point of view, be below par; but they are never totally incapacitated except during an acute exacerbation. As time goes on, the interval between the attacks increases and the severity diminishes."

Contra-indications to operation. In the New York Hospital series, there were 4 patients in whom the symptoms and physical signs were too indefinite to justify surgical treatment: pregnancy in 3; cardiac disease in 3; mental disease in 2; epilepsy in 1; lactation in 1; aortic aneurism in 1.

Pre-operative time in the hospital. The pre-operative time in the hospital varied between a few hours and 30 days, the average being 2.2 days. Most of these series were studied for 1 or 2 days before operation. Some were observed for several days, either due to doubt in diagnosis, lack of consent of the patient, or until an acute exacerbation had subsided. Salpingitis should always be an operation of election, not of necessity; that is, not an emergency unless there is considerable doubt in the diagnosis, the doubtful disease being an emergency.

Postoperative time in hospital. The time spent in the hospital after operation varied between 1 and 92 days, the average being 15.3 days. In an ordinary, uncomplicated, clean case, the patient was allowed out of bed on the eighth or ninth day and was discharged on the tenth or eleventh postoperative day. Drainage cases, cases developing abdominal wall abscesses, and other complications were the causes of prolonged hospitalization.

Miller found that early operation caused more postoperative complications. Of the 83 patients in his series of 600 who developed postoperative complications, 59 or nearly 72 per cent had not been sufficiently cooled. The same conclusions were arrived at in the patients running a postoperative elevation of temperature.

SECONDARY OPERATIONS WHILE IN HOSPITAL

There were 22 secondary operations, this being 5 per cent of cases: posterior colpotomy for secondary pelvic abscesses in 5 cases; laparotomy for secondary pelvic abscesses in 3; laparotomy following posterior colpotomy in 2; laparotomy following dilatation and currettage in 1; for intestinal obstruction in 1; for ectopic pregnancy in 1; incision and drainage of wound abscess in 2; incision and drainage of hæmatoma of back in 1; dilatation and currettage in 1; repair of immediate postoperative hernia in 1; for fæcal fistula in 1; nephrectomy in 1; incision and drainage of axillary abscess in 1; for duodenal ulcer in 1.

The foregoing is of no especial importance except to show that secondary pelvic abscesses occurred in 8 cases, and that other important surgical procedures are sometimes necessary while patients are recovering from salpingectomy. This is another argument in favor of having the general surgeon treat salpingitis as well as the gynecologic surgeon.

POSTOPERATIVE INTESTINAL OBSTRUCTION

There were only two cases of intestinal obstruction following operation; one caused death, the other was cured.

POSTOPERATIVE INCISIONAL HERNIA

There were 13 ventral hernias reported following operation, making 2.96 per cent of cases. The time these occurred or were reported varied from 1 month to 7 years, the average being 22 months; 9 of the hernias followed operations in which abdominal drainage had been used. The remaining 4 had had no abdominal drainage; 1 case was complicated by syphilis and 3 by general peritonitis. In one of the latter 4 cases, the hernia was repaired 4 months after operation, but recurred a year later. This was an acute case in which bilateral salpingectomy and appendectomy had been made with no drainage. In another, an acute exacerbation, there had been two laparotomies 8 months apart, both with drainage, and not until 9 months after the second operation did the hernia occur.

MORBIDITY

The hospital morbidity ranged between 1 and 92 days, the average being 15.1 days.

MORTALITY

In our series, 15 deaths occurred, making a general mortality rate of 2.75 per cent, and a postoperative mortality rate of 3.42 per cent. There were 127 patients operated upon during active infection. This was 29 per cent of the cases operated upon and 23.3 per cent of the cases admitted. Twelve of the 15 deaths were in patients who had been operated upon during active infection; thus there was a mortality rate of 9.45 per cent in cases operated upon during active infection or before they had "cooled."

In Miller's series of 600 cases, there were 18 or 3 per cent of deaths; 16 of these were operated upon early.

Ricci, in reviewing 600 cases at the Metropolitan and City Hospitals, New York City, finds a much higher death rate. He divides his cases as follows: (1) non-operated upon no mortality; (2) non-infective chronic cases, operated upon 0.05 per cent mortality; (3) purulent acute and chronic cases operated upon 14.5 per cent mortality. Also, he does not include in his mortality rates deaths from causes such as "embolic processes, intestinal injuries, cardiac failures, and ether pneumonias."

All of the deaths in our series were postoperative, the causes being: 9 from general peritonitis; 4 were sudden deaths on the operating table; 1 of intestinal obstruction; 1 of acute dilatation of the stomach; 1 of a cerebral accident; 1 of lung abscess.

A short résumé of all of the cases that died in the hospital following operation is given, the nature of the case, the cause of death, complications, mistakes, etc.:

CASE 1. D. D., aged 26 years, admitted to hospital June 3, 1925, with the diagnosis of cystoma of the ovary; complications—chronic appendicitis and abortion; operation—appendectomy and excision of cyst. Patient was discharged apparently cured. On June 25, 1925, she was readmitted with a history of severe deep pain in the lower right quadrant for the past 4 days associated with vomiting, dysuria, and vaginal discharge. Examination showed bilateral abdominal tenderness and rigidity, more marked on the right side; temperature 103 degrees; leucocytes 20,200 with 90 per cent polymorphonuclears. The patient was very ill and was operated upon the day after admission. Bilateral salpingitis with pelvic abscess which had perforated into the cæcum was found. The tubes were removed, the abscess was drained, and the perforated cæcum was repaired. Patient died suddenly on the operating table of ether narcosis or pulmonary embolism.

This patient should probably not have been operated upon, as it was an acute fulminating case.

CASE 2. M. C., aged 46 years, admitted to hospital July 25, 1926, with pain in the epigastrium and lower right quadrant for 16 days; no vomiting; indefinite tenderness and mass in the lower right quadrant but no rigidity; temperature 104 degrees F.; leucocytes 20,000 with 90 per cent polymorphonuclears. The diagnosis was difficult, the factors in the differentiation being fibroid uterus with partial intestinal obstruction and cystitis. Panhysterectomy was done for acute exacerbation tubes, oophoritis, and fibroid uterus a few hours after admission. Patient died suddenly on the operating table—cause unknown but probably cardiac weakness from prolonged sepsis.

This was a case of acute exacerbation and should have been allowed to subside; the cause for the immediate operation was doubt in diagnosis.

CASE 3. A. T. S., aged 60 years, admitted to hospital December 6, 1926, with a history of cramp-like pain in the abdomen for 8 days, with vomiting. Abdominal examination showed generalized tenderness and rigidity; vaginal examination showed tenderness in both fornices; temperature was 99 degrees; leucocytes 7,120 with 87 per cent polymorphonuclears. Incorrectly diagnosed as intestinal obstruction, and the patient was operated upon 2 days later. This was really an acute case of salpingitis and should have been allowed to subside. Pelvic abscess with general peritonitis was found on operation. Right salpingectomy and posterior colpotomy were done. The patient lived 30 days.

In this case, both the temperature and the leucocytes were low, even in the presence of general peritonitis. This, with the fact that the patient did not react well to operation and did not improve, shows that there was very poor resistance on the part of the patient.

CASE 4. M. A., aged 49 years, admitted to hospital March 17, 1925, with a history of an attack of lower left abdominal pain 6 months previously, followed by irregular menstruation. Abdominal examination showed slight tenderness in the left lower

quadrant; vaginal examination showed an enlarged uterus pushed to the right by a large mass in the left fornix; temperature 100 degrees; leucocytes 12,000 with 88 per cent polymorphonuclears. A mistaken diagnosis of uterine fibroid was made, and a few hours after admission a panhysterectomy was done for chronic salpingitis and chronic endometritis. After the operation, the patient seemed to have no resistance and developed general peritonitis, with partial intestinal obstruction, for which a jejunostomy was done on the second postoperative day. Following this, there was no improvement, the patient dying on the fifth postoperative day.

CASE 5. D. V., aged 25 years, admitted to hospital March 13, 1927, and died the following day. Patient complained of pain in the lower abdomen with a history of painful abdominal attacks for the past 2 years. She had never been acutely ill. There was no nausea or vomiting. The attacks were aggravated by exertion, such as bending over. Recently, there had been little or no pain, but as the patient had never been pregnant and wished to have children, she came to the hospital for advice. Examination of the abdomen was negative; vaginal examination showed bilateral tender masses; temperature 100 degrees; a bilateral salpingectomy and appendectomy were done. The pathological report showed the process to be chronic tuberculosis of both tubes. The patient died on the operating table of ether narcosis.

CASE 6. C. G., aged 32 years, admitted to hospital August 6, 1927; died 4 days later. Onset with pain in the abdomen said to have followed trauma, the latter being preceded by pain in the back. Examination showed tenderness in the lower right quadrant, enlarged right ovary, and tenderness in both vaginal fornices; temperature 99 degrees; leucocytes 6,400 with 77 per cent polymorphonuclears. The diagnosis was difficult, anteflexion and anteversion of the uterus and acute appendicitis being excluded. The patient was operated upon the day after admission, a bilateral salpingectomy, left oophorectomy, and appendectomy being done. Recovery was apparently uneventful when some cerebral accident occurred on the fourth postoperative day, causing death.

CASE 7. R. S., aged 46 years, admitted to hospital December 5, 1914, complaining of sticking pains in the right lumbar region. According to the history, the onset of sticking pains in this location occurred 2 months previously, was moderately severe in character, and was associated with chills and fever; pain was worse a few days before each menstrual period, radiated to the lower right quadrant, and was aggravated by respiration. Appetite had been poor, but there had been no nausea or vomiting; had been in bed off and on, depending on the severity of the pain. A few days, just prior to admission, the patient had noticed tenderness in the lower right quadrant. Abdominal examination was practically negative. Vaginal examination showed a bloody uterine discharge and tenderness of the cervix and both fornices. Temperature 98.2 degrees. Conditions considered in the differential diagnosis besides salpingitis were: acute appendicitis, ovarian cyst with twisted pedicle, ruptured ovarian cyst. No definite diagnosis was made before operation. A dilatation and curettage were done showing evidence of chronic endometritis. There was no improvement. The symptoms and signs persisted, and the general condition became worse, general peritonitis setting in, so an exploratory laparotomy was decided upon. The left broad ligament was the seat of a large globular swelling, cystic in character, but when ruptured was found to contain pus. The patient did not react to the operation and died in a few hours of general peritonitis.

Although it was impossible to make a definite diagnosis in this case, a mistake was made in operating because it was an acute exacerbation which had a better chance of subsiding without operation. This is a typical case of fulminating acute exacerbation with general peritonitis.

CASE 8. L. N., aged 23 years, admitted to hospital November 22, 1915, and died 8 days later; history of irregular menstruation, dysmenorrhœa, dysuria, backache, and vaginal discharge; examination showed bilateral tenderness and a vaginal discharge; temperature 98.4 degrees. It was a chronic case, easily diagnosed. The patient was operated upon 2 days after admission—bilateral salpingectomy for hydrosalpinx, left oophorectomy, and appendectomy being done, without drainage. Soon after operation, she developed acute generalized streptococcus peritonitis. Abdominal drainage was instituted on the fifth postoperative day, but the patient died the next day because of the fulminating infection.

It is difficult to see how there could have been any anticipation or prevention in this case.

CASE 9. L. S., aged 25 years, admitted to hospital May 21, 1916, and died July 3, 1916. History for the previous year was of irregular menstruation and dysmenorrhœa; for the past 5 days headache, chilliness, and pain in the back and legs. Examination showed tenderness and rigidity in the left lower quadrant; temperature 101.2 degrees; leucocytes 20,000 with 88 per cent polymorphonuclears. The diagnosis was difficult, typhoid fever and migraine being excluded. The patient was operated upon 2 days after admission—bilateral salpingectomy and left oophorectomy without drainage being done for an acute exacerbation process. The exacerbation should have been allowed to subside before operation. The patient lived for 11 days after operation. Death was caused by complications which developed after operation; acute dilatation of the stomach, general peritonitis, pleurisy, atalectasis, and hæmatoma of the back.

CASE 10. R. D., aged 31 years, admitted to hospital April 9, 1920, and died 2 days later. The his-

tory disclosed pain in the lower left quadrant and back following delivery 1 month previously, also urinary frequency and vaginal discharge. Abdominal examination showed a tender mass in the lower left quadrant. Vaginal examination showed a mass in the left fornix. Temperature 98.8 degrees. The diagnosis was difficult—dermoid cyst of the ovary being considered and so diagnosed. Patient was operated upon the day after admission, a left salpingo-oophorectomy without drainage being done for an acute exacerbation process, which should have been allowed to subside. The pelvic peritonitis which was present spread rapidly and the general condition of the patient became progressively worse. She died the following day.

CASE 11. E. L., aged 22 years, admitted to hospital May 14, 1920, and died June 4, 1920. She complained of cramp-like pain in the epigastrium, vomiting, and belching of gas. The history was that 6 days previously, she had had a slight epigastric disturbance following the evening meal and vomited a small quantity of foul smelling material; 5 days before admission, she had a chill with fever, took magnesia and vomited, but had no pain at that time. The following day she was able to get up and did some work. Three days before admission, she had another severe chill with fever and went to bed; also had a sore throat; vomited again and eructated gas. The next day the temperature remained high, belching continued, and on the morning of admission she complained of sharp cramp-like pain in the epigastrium, radiating to the middle of the back, and again vomited. She gave a history of previous attacks of indigestion, but no similar attacks. Abdominal examination showed slight tenderness in the epigastrium, none elsewhere. Vaginal examination showed a moderate discharge but no tenderness; temperature 105.2 degrees; leucocytes 16,000 with 88 per cent polymorphonuclears. The temperature remained very high for the next 20 days, running a septic course. Due to progressive weakness and toxicity of the patient, an exploratory laparotomy was done. Acute pyogenic infection of the left tube and ovary, with pelvic peritonitis, peri-sigmoiditis, and peri-appendicitis were found. A left salpingo-oophorectomy and an appendectomy were done. Culture from the ovary which was removed showed a pure growth of hæmolytic streptococcus. The patient reacted poorly to the operation, the temperature rising to 106 degrees. She died 18 hours later.

This was an acute case and should have been allowed to subside without operation.

CASE 12. L. J., aged 44 years, admitted to hospital December 8, 1920, and died the next day. History revealed irregular menstruation and bilateral pain, more severe in the lower right quadrant, labial herpes, hiccoughs, vomiting, fever, and headache. Examination showed distention of the abdomen and generalized tenderness and rigidity in the lower right quadrant; both fornices were tender, more so on the right. No diagnosis was made. The following conditions, besides salpingitis, were considered: acute appendicitis, ovarian cyst with twisted pedicle, pneumococcus peritonitis, acute diverticulitis, and ruptured ectopic pregnancy; temperature on admission was 101.2 degrees; leucocytes 27,200 with 89 per cent polymorphonuclears. Patient was operated upon after a few hours, an acute exacerbation salpingitis, appendicitis, and general peritonitis being found. The appendix was removed and the peritoneum drained, but the peritonitis was so fulminating that the patient died on the following day.

This case might have subsided if left alone. However, the lack of a definite diagnosis justified the operative procedure.

CASE 13. J. G., aged 27 years, admitted to hospital November 30, 1923, and died January 3, 1924. History of 5 weeks of pain in the lower right quadrant with vaginal discharge; examination showed tenderness in the lower left quadrant and in the right fornix; temperature 99 degrees; leucocytes 8,400 with 76 per cent polymorphonuclears. Patient was operated upon the day after admission—bilateral salpingo-oophorectomy being done for chronic disease. With the exception of an abdominal wall abscess, patient was recovering satisfactorily from the operation. Some time later a lung abscess developed. Patient was again operated upon, but died on the fourth postoperative day.

CASE 14. M. C., aged 29 years, admitted to hospital June 20, 1923, and died the next day. History of 3 weeks of sharp pain in the left lower quadrant and legs, nausea, vomiting, fever, and irregular menstruation. Examination showed tenderness and rigidity in the lower right quadrant, vaginal discharge, and a tender mass in the left fornix: temperature 103.6 degrees; leucocytes 13,900 with 67 per cent polymorphonuclears. Acute salpingitis was diagnosed, pelvic abscess also being considered. Left salpingo-oophorectomy was done the day after admission which showed the process as being acute tuberculosis of both tubes and ovaries, more advanced on the left side. The patient died a few hours later of surgical shock.

As this was definitely an acute case, it should have been allowed to subside without operation.

FOLLOW-UP

A very careful attempt at following up the patients was made. Many of them were appreciative and co-operative. On the other hand, a great many never returned, some of them having moved away, and probably many of them not wishing to advertise their condition further.

Twenty or 3.6 per cent of cases were operated upon too recently to obtain follow-up

records; 98 or 17.9 per cent were not traceable and nothing was found out or heard concerning them; 69 or 12.6 per cent were readmitted for similar or different conditions; in 57 or 10.4 per cent no follow-up records were made, either because they were unco-operative or for some other reason.

There were 20 or 3.6 per cent that returned and were considered unsatisfactory; most of these on their original admission had had an acute salpingitis which subsided, but later recurred. Some of them were cases in which one tube had been removed, there being subsequent involvement of the other tube. The time of recurrence ranged between 3 months and 2 years, the average time being 7½ months.

The latest theory is that if the infection is gonorrhœal, the so-called recurrences are not recurrences at all but are new infections introduced from without.

Two hundred five or 37.9 per cent were considered satisfactory and presented themselves with no complaints; the time after operation for these determinations ranged between 1 month and 12 years, the average being 9½ months. These records were made on determinations as follows, the time given being the last time that the patient reported: 1 month, 2 cases; 2 months, 12; 3 months, 90; 4 months, 40; 5 months, 14; 6 months, 16; 7 months, 5; 8 months, 1; 1 year, 3; 1 year and 6 months, 2; 2 years, 3; 2 years and 6 months, 2; 3 years, 4; 4 years, 1; 5 years, 2; 6 years and 6 months, 1; 7 years, 1; 8 years, 1; 9 years, 1; 10 years, 2; 12 years, 1.

There were 110 or 20.1 per cent considered satisfactory but with complaints; the time after operation for these determinations ranged between 1 month and 5 years, the average time being 6.6 months. The times considered were: 1 month, 1 case; 2 months, 5; 3 months, 45; 4 months, 14; 5 months, 12; 6 months, 7; 8 months, 4; 9 months, 4; 10 months, 2; 11 months, 2; 1 year, 4; 1 year and 6 months, 2; 2 years, 4; 4 years, 1; 5 years, 3.

RESULTS

Three hundred fifty-six or 65.3 per cent of cases left the hospital as cured, that is, there was little probability that they would have further trouble: 131 or 24 per cent left the hospital as improved; 37 or 6.78 per cent left as unimproved; 38 or 6.9 per cent left against advice—untreated; 14 or 2.5 per cent died in the hospital; there were records of the subsequent deaths of only 3 or 0.5 per cent of cases.

Of the results that were considered unsatisfactory, some of the patients' complaints on return were: pain and tenderness in the lower right quadrant, and tenderness in the right fornix; tenderness in the lower abdomen; foul vaginal discharge; loss of weight and epigastric pain; pain and hard tender mass in pelvis; pain in lower left quadrant; pain in abdomen, vaginal discharge, urinary frequency, and dysuria; pain in the left side; mass in the lower right quadrant and in the right fornix.

The cases that were considered satisfactory but had complaints were: irregular menstruation in 5 cases; excessive menstruation in 2; dysmenorrhœa in 5; amenorrhœa in 4; scanty menstruation in 1. Pain was complained of as occasional in 12 cases; in the back in 10; in the left groin and backache in 1; incisional in 7; indefinite in 12; persistent in the left side in 3; in the lower right quadrant in 4; dragging in 1; abdominal, unclassified in 4; in the upper abdomen in 2.

Symptoms of ovarian dysfunction or artificial menopause were found in 8 cases, as listed below. This is an important determination to make and a factor that must be watched carefully after pelvic operations:

1. Eleven months after hysterectomy and left oophorectomy and salpingectomy for an acute exacerbation process, the patient complained of menopause symptoms and was given ovarian extract with satisfactory results.

2. Three months after bilateral salpingo-oophorectomy, the patient had hot flashes, nervousness, and palpitation.

3. Three months after bilateral salpingectomy and left oophorectomy, uterine suspension, and perinorrhaphy, the patient complained of faintness, amenorrhœa, and leucorrhœa.

4. Three months after right salpingo-oophorectomy, the patient complained of hot flashes and amenorrhœa.

5. Five months after left salpingo-oophorectomy, appendectomy, and cholecystectomy, the patient complained of amenorrhœa and dyspareunia.

6. Three months after bilateral salpingo-oophorectomy, the patient had dysmenorrhœa and leucorrhœa.

7. Ten months after left salpingo-oophorectomy and appendectomy the patient's condition was unsatisfactory due to menopause symptoms.

8. One year after panhysterectomy, the patient complained of amenorrhœa.

Besides these, there were some leucorrhœa in 10 cases; foul vaginal discharge in 7; slight tenderness in both fornices in 1; abdominal and rectovaginal fistulæ in 1; dysuria in 4; tender cystic ovary in 1; irregular menstruation with pain in the lower left quadrant in 1; weakness of incision in 1; ventral hernia in 13; hard mass in right fornix in 1; discharging abdominal sinus in 1.

Other complaints and conditions found were: Symptoms of early pregnancy in 8 cases; indigestion in 3; also hæmorrhoids, rheumatism, morning nausea, constitutional psychopathy, hysteria, neurasthenia, pregnancy and syphilis, fibroids, constipation, cough and vomiting, bleeding from rectum, tuberculous arthritis, pulmonary tuberculosis, dyspareunia, headaches, prolapsed uterus, obesity, nervousness, and slight elevation of temperature.

The diagnoses of the patients readmitted were: Salpingitis in 15 cases; inguinal adenitis in 1; laceration of the cervix with secondary hæmorrhage in 1; fæcal fistula in 1; fibromyoma of the uterus in 5; constitutional psychopathy in 1; ectopic gestation in 4; ventral hernia in 10; cystic ovary in 5; Bartholin's abscess in 2; retroversion of the uterus with adhesions in 1; retroversion of the uterus in 1; chronic endometritis in 2; postoperative adhesions in 2; chronic appendicitis in 4; miscarriage in 2. And one case each of the following conditions: Relaxation of the perineum, prolapse of the uterus, acute gastritis, acute dilatation of the stomach, hæmorrhoids, fistula *in ano*, cellulitis of abdominal wound, cholecystitis, intestinal hæmorrhage, syphilis, arthritis of the knee, duodenal ulcer, tuberculosis of the vertebræ with psoas abscess, and tuberculous peritonitis.

Note the nature of the original operation in some of the previously mentioned 15 patients that were readmitted with the diagnosis of salpingitis:

1. Three months following right salpingectomy, appendectomy, and dilatation and currettage, the patient's condition was unsatisfactory, complaints being loss of weight and epigastric pain. Examination showed an enlarged boggy uterus.

2. Four months following right salpingo-oophorectomy and appendectomy, the result was unsatisfactory, the patient complaining of pain. A hard tender mass was found to the left of the uterus.

3. Five years after right salpingo-oophorectomy, the patient had an acute left salpingitis; left salpingo-oophorectomy was done.

4. One month after right salpingectomy and appendectomy, the patient had a large tender left tube which subsided.

5. Five years after right salpingo-oophorectomy and appendectomy, the patient had left salpingitis, acute exacerbation, and left salpingo-oophorectomy was done.

6. Eight months after left salpingectomy and appendectomy, the patient was readmitted with acute pelvic peritonitis which subsided without operation.

7. Four months after right salpingo-oophorectomy and appendectomy, the condition was unsatisfactory, the patient complaining of pain in the lower left quadrant, and dysmenorrhœa; an enlarged tender prolapsed ovary was found on examination. The patient refused operation.

8. Seven months after right salpingectomy, the condition was unsatisfactory, the patient complaining of pain in the left side and vaginal discharge. Examination showed a marked exfoliative vaginitis.

9. Four years after left salpingo-oophorectomy, the patient was readmitted with chronic right salpingitis and postoperative adhesions. Right salpingectomy, appendectomy, and freeing of the adhesions was done.

10. One year and 6 months after right salpingo-oophorectomy and appendectomy, the condition was unsatisfactory and left salpingo-oophorectomy was done.

11. Four months after right salpingectomy and appendectomy, the condition was unsatisfactory and the patient complained of pain in the back and in both sides and nervousness.

12. Four months after partial right salpingectomy, right oophorectomy, uterine suspension, etc., the condition was unsatisfactory, the patient complaining of profuse vaginal discharge, headache, pain in the back, and dysmenorrhœa.

No definite data could be found in regard to whether or not it is advisable to do conservative surgery in diseased tubes, that is,

whether partial salpingectomy and plastic operations are worth while.

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STATISTICAL REPORT OF CAUTERY SURGERY IN UTERINE CARCINOMA[1]

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IN this city thirteen years ago (1915) in an address[2] before the Clinical Congress of Surgeons, I said in part: "It is only fair to state that when I publish the statistics of my first one hundred cases (of cautery surgery in uterine carcinoma) the results in the advanced patients are not going to be such as to arouse enthusiasm on the part of many surgeons; much of this will be due to the fact that I have been exploring a practically unknown field, risking too much, perchance, but always with the hope that, if I could destroy the gross mass (of pelvic carcinoma with heat), the patient's assumed natural defensive forces would care for the implied present or future metastases. With increasing knowledge of what can be done in this way with the otherwise utterly inoperable, often terminal, third-stage cancer patient by the application of heat, entirely eliminating the cold knife; by better judgment and operative technique, combined with added experience in their management both pre- and postoperative; possibly by employing a two-stage cautery knife procedure, and perhaps following this with the limit of normal tissue toleration of radio-active agents, I know that a degree of palliation can be obtained in all, and a five or more years' respite or cure in many, that is well worth while."

My first cervical cancer patient was treated with soldering irons September 22, 1903, twenty-five years ago. The abdomen was not opened. The irons were heated to a cherry red color and plunged into the mass through an asbestos covered vaginal speculum and kept there until the cautery stopped simmering in the involved tissues. This was repeated, often many times, until it was judged that the malignancy in the cervix, uterocervical junction, or body of the uterus was thoroughly destroyed. It was assumed that this was accomplished when tissue structures normally movable but fixed by the pathology were made normally movable again by the heat applications. The patient lived 1 year and 7 months (1) and died from toxæmia incident to local recurrence of her primary trouble. This possibly crude, but not always unavailing, cautery method was made more rational in 1914 as a definite surgical procedure, when I opened the abdomen preliminary to the application of an electrically heated cautery, in place of the soldering iron, to cervical and uterine body carcinoma. The first patient (Mrs. E. H. W., Table I) in whom I employed this technique for the safer and definitely more effective cautery destruction of cervical cancer, required two rather widely separated applications of the method. Her pre-operative history, preliminary to the first cautery application, concerns a "profuse, bloody, watery, very offensive, vaginal discharge for over one year, with pain extending down the right thigh as far as the knee, and a harassing cystitis. Nocturia three to four times, at which times she required fresh pads because of the vaginal flow. The entire cervix was found occupied by an exuberant cauliflower-like mass." The postoperative history of the first cautery treatment August 2, 1912, was completely satisfactory for 2 years and 4 months, when she returned with an extensive recurrence of cancer in the body of the uterus. It was at the second operation (November 27, 1914) that her abdomen was opened for the treatment of the recurrence and cautery excision of the uterus employed intra-abdominally. This is, as far as I have been able to discover, the first time that the abdomen was ever opened for the complete removal of vaginal, cervical, or uterine cancer by the cautery knife, or for the infiltration of a destructive degree of heat into the uterus from the vaginal side, both of which were practiced in this woman's pelvic cancer. It will add interest and value to this report on the heat method to state that this patient is alive

[1]Heat in the treatment of carcinoma of the uterus. Surg., Gynec. & Obst., 1916, xxii, 77–79.

Presented in the Cancer Symposium at the meeting of the Clinical Congress of Surgeons of North America, Boston, October 8–12, 1928.

and well 16 years and 2 months following the first application of cautery heat to her spreading carcinoma of the cervix, and 13 years and 10 months following the second operation (1914) when the abdomen was opened and her uterine body carcinoma (together with what was left from the original vaginal cauterization of the uterocervical junction and vault of the vagina) removed abdominally with the cautery knife.[1] It should also be stated that at the second operation there was no physical evidence, either in the vault or walls of the vagina, of carcinoma left over following the first application of the cautery heat. If this were the only favorable experience I have had following the employment of my technique in both early and late extensive pelvic cancer, it would not be noted as of more than passing significance.

This report is based on a total of 134 patients here referred to generically as suffering from cervical carcinoma. My first patient with this condition, I repeat, was cauterized in 1903. I have included no patient who was treated later than October, 1925. Because of interruptions incident to the Great War, I did no pelvic cancer surgery from January, 1918, to January, 1923—5 years. For the purposes of this report this permits the division of the cautery treatment of my pelvic cancer patients into two periods: The first comprising 28 private patients treated with the cautery between 1903 and all the months of 1917, and the second period from early in 1918 to October, 1925. The patients treated in this second period (1918–1925) can be classified into private and institutional, of which there were 23 of the first and 83 of the second. In the first period (1903–1917) all of the patients were private. The private patients combined in the two periods total 51. This number, added to the 83 treated in institutions, accounts again for the total of 134 patients. In the first period, with 28 patients, 9 are alive and well (32 per cent) from 9 to 19 years.

Of the practically unselected institutional cases, 83 in number, 54 can be classed as palliative, for the reason that they had developed one or more of the characteristic outstanding features of recurring cancer, viz.: hæmorrhage, foul discharge, cachexia, frozen pelvis and pain, not to mention additional distressing marks distinctive of the advanced pelvic cancer patient demanding relief. Forty-four of these lived, following attempts at palliation with the cautery, from one day to 2 years and 7 months. The remaining 10 of the 54 (2 of which were recurring cases) are at present untraced 15 days to 1 year and 5 months following operation. Six of the 83 mentioned above were given radio-active treatments and all are dead. Three died in 4 days following the completion of their treatments; one in 14 days; one in 3 months and one in 1 year. This latter patient, in addition to the radio-active agents, had three intravenous infusions of colloidal copper ("Cuprase"). The remaining 23 of the 83 were straight cautery cases, i.e., they were primarily and only treated with the cautery. Of these, 12 lived from 2 days to 1 year and 4 months after its employment, as follows: one lived 2 days; one, 3 days; three, 5 days. In one of the five both ureters were damaged. One patient lived 14 days and died of peritonitis; one lived 17 days; one, 4 months, one, a year; three, 1 year and 4 months. Eleven of the 23 patients are alive and well after the 3 year period (48 per cent). Seven have passed the 4 year period (30 per cent), and 3 have reached the 5 year period (13 per cent). Therefore, 27 in the total of 134 patients are alive and well from 3 to 19 years. This gives, in all of the cases for all of the years between 1903 and 1925, an average of good results of 20 per cent. It will be noted, however, that 2 of these cautery operated upon patients are alive and well just over the 3 year limit, and as most of us know, the third year is the graveyard of great numbers of cancer statistics. One of the remaining 3 year symptom-free patients was operated upon November, 1923, and is untraced after entering the fourth year, while 2 have entered safely into the second half of the fourth year.

The pathology in these 27 symptom-free cases was reported by the laboratories as follows: Squamous cell carcinoma, 16 cases; adenocarcinoma, 6 cases; and carcinoma, 5 cases.

[1] In a footnote in a former paper (Am. J. Obst., lxxvii, Nov. 1, 1918) it was erroneously stated that I first opened the abdomen for the more thorough dissemination of heat in pelvic carcinoma August 2, 1912. The correct date, as stated above, was November 27, 1914.

TABLE I.—BRIEF RÉSUMÉ OF THE CONDITIONS OF NINE CURED PATIENTS OF TWENTY-EIGHT IN FIRST PERIOD AT TIME OF CAUTERY OPERATION, WITH SUBSEQUENT HISTORY TO OCTOBER 15, 1928.

	Age	Explanatory numerals	Living and well
Mrs. F. H. F...	45	4, 7, 8, 9, 12, 15, 16, 17, 19, 21, 27, 39, 41, 42, 48, 49, 51	19 yr.
Mrs. A. G. H..	42	11, 15, 17, 19, 21, 27, 40, 41, 48, 49, 50	10 yr. 6 mo.
Mrs. E. H. W..	52	7, 8, 13, 14, 17, 19, 21, 26, 27, 41, 42, 43, 48, 49, 51	16 yr. 2 mo.
Mrs. J. M. M..	45	7, 15, 17, 21, 27, 33, 41, 48, 51, 52	13 yr. 3 mo.
Mrs. Maud McC.....	54	4, 7, 9, 12, 14, 18, 21, 22, 32, 41, 45, 48, 50	13 yr. 7 mo.
Mrs. J. L. D...	29	1, 9, 12, 14, 16, 18, 20, 41, 46, 48, 51	13 yr. 8 mo.
Mrs. W. E. B..	36	14, 18, 20, 53, 54, 55, 56	10 yr. 8 mo.
Mrs. Theodore M.....	28	17, 18, 20, 51, 53, 54, 56	10 yr. 7 mo.
Miss A. Q. N...	39	12, 14, 17, 18, 20, 41, 43, 50, 53	9 yr. 3 mo.

TABLE II.—EXTENT OF CERVICAL CARCINOMA IN SEVEN SYMPTOM-FREE PATIENTS OF TWENTY-THREE, FOUR AND FIVE YEARS FOLLOWING CAUTERY TREATMENT.

	Age	Explanatory numerals	Living and well
Mrs. N. B. R..	47	9, 16, 17, 18, 20, 22, 43, 51, 53, 57, 58, 59, 60	5 yr. 6 mo.
Mrs. J. C. R...	51	9, 17, 19, 20, 22, 43, 53, 54, 56, 60, 61, 62, 63, 64	5 yr. 3 mo.*
Miss Francis S.....	54	7, 11, 14, 19, 21, 35†, 41, 50, 53, 55, 65, 66, 68†, 69	5 yr. 6 mo.
Mrs. Ida H. T.	40	12, 14, 17, 18, 20, 41, 51, 53, 55, 69	4 yr. 5 mo.
Mrs. Thos. E. McL.....	52	12, 14, 17, 20, 50, 53, 65, 69, 70	4 yr. 3 mo.
Mrs. C. S. D...	48	13, 14, 16, 17, 19, 20, 33, 41, 51, 53, 57, 66	4 yr. 2 mo.
Mrs. Sallie C...	58	14, 19, 21, 26, 51, 53, 54, 56, 65, 69, 71	3 yr. 9 mo.

*This patient's operations (Mrs. J. C. R.) occurred on the following dates: July 6, 1923—panhysterectomy with Percy cautery resection base bladder; October 2, 1923—repair vesicovaginal fistula; October 16, 1924—resection vault vagina, base bladder and both broad ligaments for extensive recurrence in these structures.

†Both these fistulæ closed spontaneously before the patient left the California Lutheran Hospital at the end of 38 days.

*EXPLANATORY NUMERALS REFERRED TO IN TABLES I AND II

1. Subtotal hysterectomy in another clinic.
4. Vesicovaginal fistula following cautery.
7. Cachectic.
8. Primary operation was with idea of palliation only.
9. Bladder involved.
11. Pelvic contents movable.
12. Pelvic contents slightly movable.
13. Pelvic contents fixed.
14. Abdomen opened.
15. Abdomen not opened.
16. Vagina involved.
17. Cervix and one, or both, broad ligaments involved.
18. Type—infiltrating.
19. Type—vegetative.
20. Iliac arteries tied.
21. Iliac arteries not tied.
22. Vesicovaginal fistula successfully closed.
26. Recauterized, 2 yr. and 2 mo.
27. High heat.
32. Gall stones.
33. Uterus came away in a slough following cautery.
35. Rectovaginal fistula.
39. Vesicovaginal fistula closed spontaneously.
40. Followed by cautery hysterectomy in five months because of recurrence in cauterized stump of cervix.
41. Pre-operative hæmorrhage and foul discharge.
42. Marked loss of weight.
43. Hysterectomy with cautery knife because of recurrence later in body of uterus.
45. Enormous umbilical hernia containing omentum and most of transverse colon.
46. Cautery resection of ileum adherent to cervical stump from former operation.
48. Previously reported. (3)
49. Soldering irons at first operation.
50. Adenocarcinoma.
51. Squamous cell.
52. Postoperative hæmorrhage controlled by packing.
53. Not previously reported.
54. Enlarged glands at bifurcation of iliacs.
55. Pyometria.
56. Iliac glands reported not malignant.
57. Percy technique with assistant's hand in pelvis.
58. One ureter involved.
59. Bladder accidentally opened with cautery.
60. Cautery resection upper one-third vagina with parametrium.
61. Cautery resection base of bladder.
62. Accidental opening left iliac vein and ligation above and below the tear.
63. This woman had three operations, two of which required resection base of bladder. 1. Panhysterectomy. 2. Repair vesicovaginal fistula. 3. Resection vault vagina, base bladder, and both broad ligaments.
64. Squamous cell—type 3 according to Broders.
65. Fat abdomen.
66. Previous amputation cervix in another clinic.
68. Abdominal fæcal fistula.
69. Wertheim technique with Percy cautery.
70. Excessive bleeding and clots for 6 months but no characteristic odor.
71. Recauterized in 9 months for small recurring nodule in vaginal vault.

It should be stated that only a small percentage of my pelvic cancer patients, operated upon with the cautery, can be classed as early cases, i.e., cases without involvement of one or both broad ligaments over periods from 8 to 18 months. Some were recurring cases operated upon in other clinics. Among these were a small number which had either been hysterectomized or received radio-active treatments or both pre-operatively or postoperatively. In other words, few were better than borderline and the many were in the usually considered inoperable class. This will be more fully appreciated when it is related that in one of the three institutional cases (Mrs. D. F. M., Nee N. P., L. A. General Hospital Case No. 192–260) listed above as alive and well beyond the 5 year period (5 years and 3 months to be exact) not only were both broad ligaments extensively involved and the uterus fixed, but the left side of the bladder with its accompanying ureter was included in the carcinomatous

process, requiring cautery resection of fully 2 inches (5 cm.), or more, of the viscus, and of 1 inch (2.5 cm.) of the distal portion of the ureter, and its reimplantation into the repaired bladder. In addition there were enlarged hard glands at the bifurcation of the iliac arteries which were pronounced adenocarcinomatous by the laboratory of the Los Angeles General Hospital (4). More than this, it was necessary to cautery dissect about 5 inches (13 cm.) of the rectal sigmoid from the pelvic mass before it was possible to remove the uterus, adnexa, and upper third of the vagina. This woman was 48 years of age at the time of her operation and has since married.

In this connection it will also be of interest to refer to (Table II), Mrs. J. C. R., whose abnormal pelvic history dated back fully two years when she was sent in by Dr. Harry J. Willey, Porterville, California, as having a probable "inoperable" cervical carcinoma. Her history when she first presented herself had the following relative to her pelvis: "A large, firm, ulcerated cauliflower-like mass which involves the cervix and extends around the uterocervical junction and into the base of the left broad ligament. There is a suspicious firmness between the uterocervical junction and the bladder." The patient complained of dysuria and a rectal tenesmus, both of which were gradually increasing. She showed evidence of loss of weight which was estimated at 20 pounds in the previous 3 months. The operative history of this patient (California Lutheran Hospital No. 84737) is interesting in that she required two separate cautery resections of the bladder with 15 months interval between. With this her carcinoma was rated as a type 3 (Broders) malignancy by the laboratory of the California Lutheran Hospital.[1]

Another patient in this same class is Mrs. N. B. R., age 47. Within the os and invading principally the anterior lip was found an easily bleeding, thickened mass about 2 inches (5 cm.) in diameter. The patient came for examination (April 24, 1923) because of a "spotting" that had annoyed her for nearly 6 months. No odor. A cautery biopsy was made from the cervix and submitted to the laboratory of the White Memorial Hospital (Case No. 8232) where it was reported an adenocarcinoma. The operation (April 26, 1923) consisted of first dilating the vagina and coning out the cervix with the cautery knife (Byrne technique) through the uterocervical junction, while an assistant grasped the uterine structures in the pelvis through the abdomen. The ligation of both internal iliac arteries was a part of this procedure, together with the removal of both tubes and ovaries. The water cooled vaginal speculum was again inserted in the vagina and the Percy ball tipped electric heating iron passed to the uterine fundus. It was maintained in this position until the uterus and contiguous parts of the uterocervical ligaments were unbearably hot to the rubber gloved hand of the assistant holding them in the pelvis. The hospital record discloses the development of a vesicovaginal fistula 6 days, and a severe hæmorrhage from the vagina 8 days, postoperative. The latter complication was controlled by gauze and a Monsel's solution packing, followed immediately by a transfusion. Mrs. N. B. R. did perfectly well until April, 1925 (two years), when she came in greatly concerned about a painful "lump" which she had discovered at the mouth of the urethra. This proved to be a typical urethral caruncle, but vaginal examination at this visit "discloses a rather hard mass estimated to be about half an inch (1 cm.) in diameter at the lower margin of the left broad ligament. It is painful when manipulated but not entirely fixed." The patient was instructed to return the following May, i.e., in one month. She failed to report, however, until August. The note on her history for this later month reads: "The mass back of the vault of the vagina on the left side is not only more pronounced but is also much more diffuse." She was sent to the French Hospital where the abdomen was opened the second time August 11, 1925. The "operative record" (No. 3475) which mainly concerns us here, in part has the following: "Fixation left broad ligament involving the bladder and ureter. No enlarged lymph nodes at bifurcation of iliacs." "What was done": "Cautery

[1]Consult numerals (Table II) describing complete findings in connection with this patient's (Mrs. J. C. R.) operation.

panhysterectomy including excision of all fixed structures: small uterus, stump of cervix, vault of vagina, left lateral wall of bladder and broad ligament, distal portion of ureter with reimplantation of healthy portion into bladder."

The patient left the hospital in 17 days in excellent condition barring a pronounced foot drop on the right side. This gradually improved so that by March 31, 1926 (nearly eight months later), it had entirely disappeared and the functioning of the foot was practically normal. The onset of the pes equinus was primarily attributed to injury of the sacral plexus during the cautery excision of the mass involving the broad ligament and bladder. It should be noted, however, that 200 milligrams (3 grs.) of spinal novocain was given as part of the anæsthetic. At the Los Angeles General Hospital where the usual maximum spinal dose of this agent is 150 milligrams (2½ grs.) in several thousand administrations there is no record of a similar experience. At the present time, 3 years and 2 months following her last operation, and 5 years and 6 months after the first cauterization of the cervix and body of the uterus, there is no evidence of cancer either locally in the pelvis or generally in the body.

In the treatment of comparable malignant pelvic involvements, if the surgeon will separate the bladder from the uterus with the cautery, isolate the ureters, when necessary, with the same instrument, and expose the common iliacs in order easily to tie their internal divisions, and at the same time keep the cautery from puncturing the weak-walled, and therefore, surgically hazardous iliac veins—and follow this by cautery extirpation of the primary malignant mass, I know that he can do more to render this class of otherwise doomed patients symptom-free for an unknown but greater number of years, than by any other method so far worked out for the cure or worthwhile palliation of pelvic cancer.

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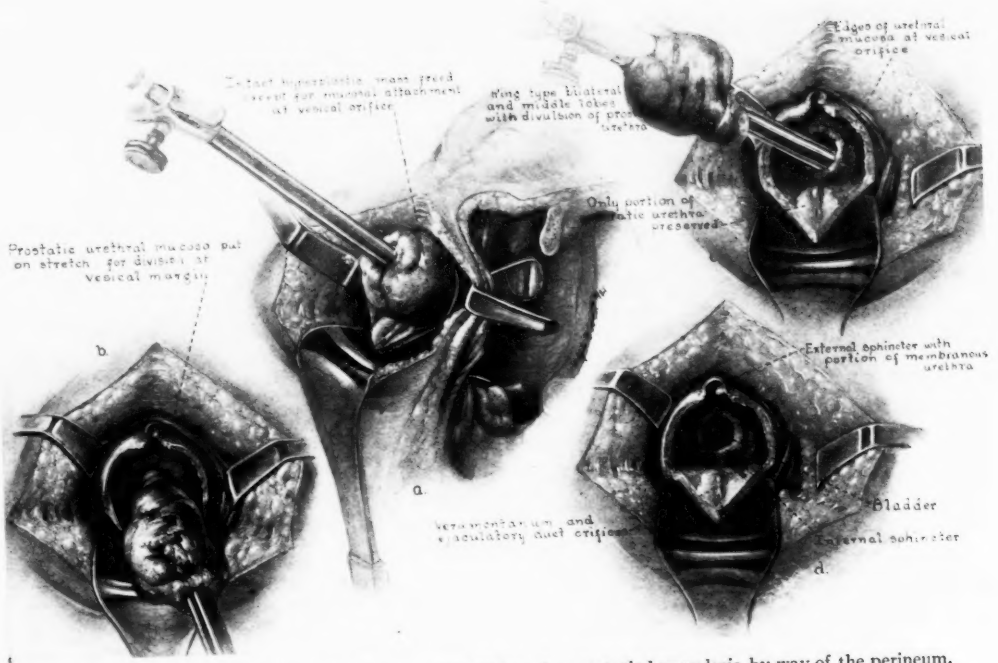

Fig. 24. Drawings to illustrate the *en masse* enucleation of a prostatic hyperplasia by way of the perineum.

Perineal Prostatectomy.—Frank Hinman

CLINICAL SURGERY

FROM THE UNIVERSITY OF CALIFORNIA HOSPITAL

PERINEAL PROSTATECTOMY

FRANK HINMAN, A.B., M.D., F.A.C.S., SAN FRANCISCO

THE story of perineal prostatectomy can be written best as an encomium of one American surgeon. It is a one way operation, and Young was the first to blaze the trail. Failure discourages all who neglect the fundamental sign posts put up by him. These are facts generally unappreciated. When this subject was suggested upon invitation to contribute an article to this section of Clinical Surgery, the reply was "most appropriate."

Perhaps the editor had in mind such a discussion or at least an explanation of the surprising vigor of this operation. The majority of medical men, urologists too, have been all dressed up for some time in anticipation of a formal necropsy. In any case, discussion of the technical details of perineal prostatectomy can be of interest to a limited number of readers for the reason that relatively few surgeons perform prostatectomy by way of the perineum. Those men who have followed successfully the perineal route take so nearly the same steps that the minor differences of technique are hardly worth discussing and are therefore of little interest even to the small group most familiar with the operation. However, other surgeons, including suprapubists, may be sufficiently inquisitive to be interested in a general discussion: first, of the anatomical principles that limit the performance of this operation practically to one way and to one way only; second, of the few technical modifications in use as related to these principles; and third, of the best way by which these principles can be taught as indicated by the experience of their twenty-five years of life.

THE ANATOMICAL PRINCIPLES OF PERINEAL PROSTATECTOMY AND CERTAIN MODIFICATIONS OF METHOD

The objectives of the perinealist are: Non-injury of the rectum and of the external sphincter, conservation of the ejaculatory ducts and of the internal sphincter, and complete enucleation of the hyperplasia with hæmostasis. Rectal fistula, incontinence of urine, or persistence of urinary abnormalities are the penalties of failure. Clean-cut dissection of the perineum in the proper line of anatomical separation of the rectum from the genito-urinary layer of perineal muscles and prostate is absolutely essential and by far the most important step from a technical standpoint, the one that has caused the most grief to both the surgeon and the patient. Once expert in exposing the prostate without the least damage to rectum and these perineal muscles, the surgeon is master of the situation. Methods of enucleation and of repair, while important, can vary just a little according to individual preference. But there is no possible variation in the line of dissection to expose the prostate—go too high and you encounter the bulb and bleeding; pass this and continuing too high you expose the triangular ligament, even Cowper's gland, and persisting will invariably injure the external sphincter; go too low, and you've got a hole in the rectum. Perineal prostatectomy, therefore, anatomically speaking consists of three stages: (1) exposure of the prostate, (2) enucleation, and (3) repair with hæmostasis.

Exposure. Good surgical exposure of the prostate is no doubt possible without special instruments. Possibly it can be done with ordinary retractors and with the patient in an indifferent spread-legged position. Theoretically all that is required is to hug the anterior surface of the rectum to the base of the gland, and any clever surgeon with a finger in the rectum as a guide and a pair of dissecting scissors should be able to do this. Large metal guides have even been proposed to be inserted rectally to facilitate the procedure by leaving two hands free for it. But this attitude toward the operation is entirely wrong. Forget the rectum. If you do an anatomical dissection of the *perineum*, and don't just mess things up, to reach the prostate you can forget it; and less than once in a hundred will you have to stick in a finger for help. A good exposure secured by position, incision, and retraction is essential to good surgery

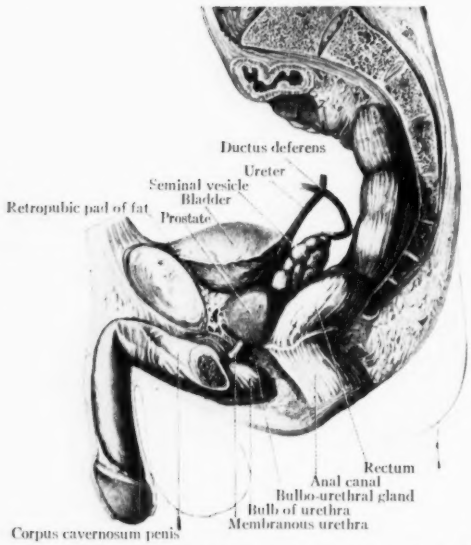

Fig. 1. The relation of the normal prostate to the neck of the bladder with the internal sphincter and to the triangular ligament with the membranous urethra and external sphincter and also the intimate relationship of the flexura perinealis recti to the posterior prostatic surface. (Reproduced from Piersol's *Human Anatomy*, 5th ed., Fig. 1662.)

any place, and a good exposure of the prostate is not secured by simply following the rectum down to it, even though this actually is what you do.

The prostate lies between the neck of the bladder with the internal sphincter and the triangular

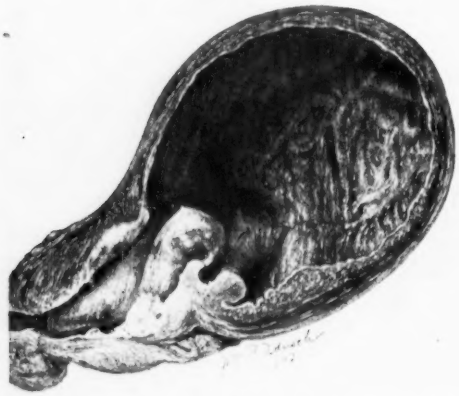

Fig. 3. Another view of a median lobe hyperplasia projecting intravesically inside the internal sphincter. (From Young's *Urology*, vol. 1, Fig. 19.)

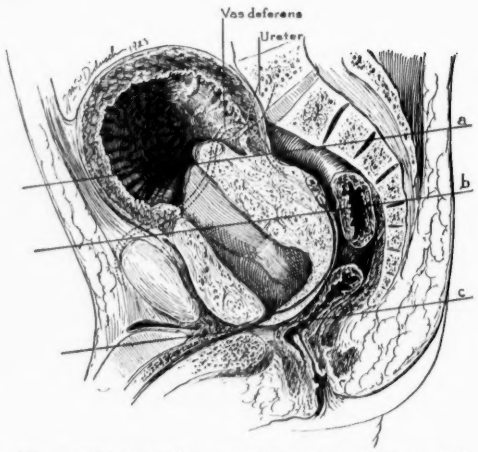

Fig. 2. Illustrates the marked elongation of the prostatic urethra with hyperplasia. The verumontanum with the ejaculatory ducts are crowded into the rectal fossa and the mucous surface of the prostatic urethra is markedly increased. The hyperplasia projects intravesically inside the internal sphincter, dilating it, but there is no disturbance of the external sphincter which lies in the triangular ligament at the position penetrated by the line marked *c*. (From Young's *Urology*, vol. 1, Fig. 239.)

ligament with the external sphincter (Fig. 1). Enlargements project intravesically inside the internal sphincter but never inside the external sphincter, though it may be pushed outward by the extravesical elongation of the urethra (Figs. 2 and 3). The rectum passes obliquely forward in the pelvis to the posterior surface of the prostate and then turns backward by the "Flexura perinealis recti," to follow the curve of the sacrum upward (Fig. 4). Freeing the rectum and straightening this perineal flexure exposes the prostate. Familiarity with the position, interrelation and function of certain perineal structures makes this possible and insures successful perineal prostatectomy. But it must be emphasized that no part of the human body shows greater variability than some of these perineal muscles, so that each operation to a certain extent demands an anatomical dissection of that individual perineum.

The *central point of the perineum*, immediately behind the bulb and about an inch above the anus, is the initial sign post of the operation. It is here sometimes by a fibrous septum, at others by direct fusion, that the external anal sphincter, the two transversus perinei, and the bulbo-cavernosus muscles meet (Fig. 5). Division of the attachment of the musculus sphincter ani externus at this point is the first step toward freeing the rectum. By this division the anal muscles (sphinc-

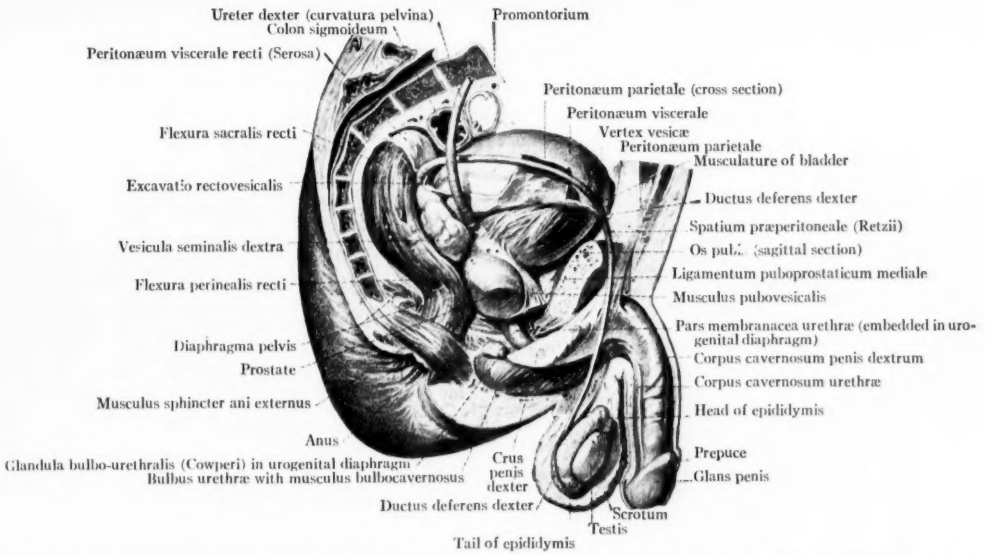

Fig. 4. Diagrammatic representation of the relations of the genital and rectal structures, showing how the rectum follows the curve of the sacrum and the genital structures lie snugly against it above. By straightening the bend in the rectum at the flexura perinealis recti plenty of room for prostatic enucleation is secured. (From Braus: *Anatomie des Menschen*, 2d Bd., 1924, Fig. 211.)

ter, levator, and coccygeus) and the genito-urinary muscles (transversus perinei, ischiocavernosus, bulbocavernosus, and constrictor urethræ) are divisible into an anterior (genito-urinary) and posterior (anal) layer. The posterior layer forms the pelvic diaphragm (Fig. 6), but the levator alone concerns the operator. "The levator ani is a broad fleshy layer which extends from the anterior and lateral parts of the pelvic wall downward and inward to the middle line, and forms, together with its fellow of the opposite side, a muscular floor to the greater part of the pelvic cavity. It takes origin from the pelvic surface of the body of the pubis by thin tendinous fibers, placed between and intimately adherent to the pubic attachments of the obturator and rectovesical fascia, from the pelvic fascia along the line of origin of the rectovesical fascia, and to a slight extent from the ischial spine. Some fasciculi are also frequently added to the forepart of the muscle from the upper layer of the deep perineal fascia. The hinder fibers pass downward and inward to the lateral margin of the coccyx; the foremost ones run almost directly backward to the central point of the perineum; and the intervening ones descend with varying degrees of obliquity to the lower end of the rectum and to a narrow median aponeurosis common to the muscles of the two sides between the tip of the coccyx and the anus.

"The levator ani is divided by a cleft beginning just below the obturator canal into two portions, only the anterior of which is directly connected with the rectum. This portion (the pubococcygeus of Savage) includes the fibers springing from the pubis and the adjoining part of the fascial origin, and is to some extent bilaminar: its outer or superficial fibers run backward over the side of the prostate and rectum, being closely applied to the highest bundles of the external (anal) sphincter, of which they seem to form a continuation upward, and becoming united with the corresponding part of the opposite side behind the bowel are inserted into the tip of the coccyx. The inner or deep fibers are partly inserted into the wall of the rectum, making their way between the external and internal (anal) sphincters to join the longitudinal fibers of the bowel; but a few anterior ones meet and decussate with those of the opposite muscle in front of the anus, and the posterior fibers similarly join with those of the other side to be attached to the front of the coccyx."[1]

Those fibers that form a continuation of the highest bundles of the external anal sphincter with those that sometimes are joined to the forepart of the levator muscle from the upper layer of the deep perineal fascia are frequently well developed, thus uniting the rectum more or less securely to

[1]Quain's *Anatomy*, vol. ii, Part 2, page 343, 1899.

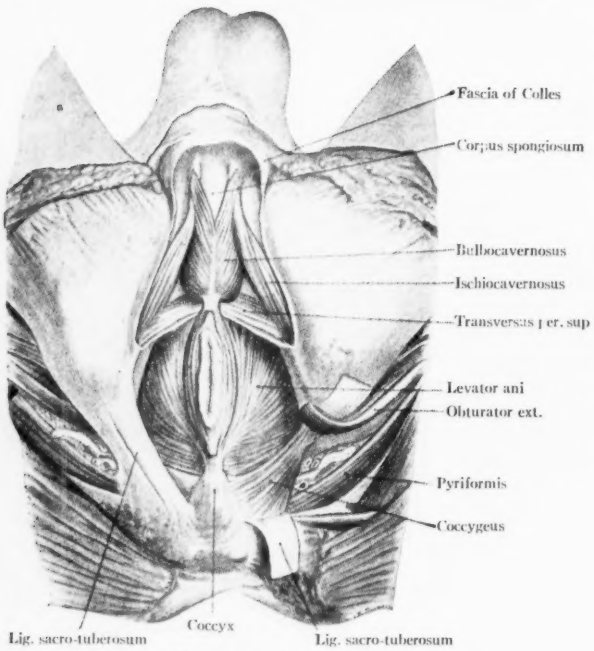

Fig. 5. Drawing illustrating the central point of the perineum and the structures attaching at this point, namely the bulbocavernosus, transversus perinei, the musculus sphincter externus, and levator ani. Division just below this point is the first step toward separating the anal layer of muscles from the genito-urinary layer of muscles. (From Quain's *Anatomy*, vol. iv, pt. 2, 1923, Fig. 72.)

the anterior or genito-urinary layer of muscles, and are usually designated as the recto-urethralis muscle. They are quite variable but when prominent their clean-cut division with scalpel is necessary to freeing the rectum at this second step of the dissection. When few and weak, blunt finger dissection may easily free the rectum to the apex of the prostate, but such blunt dissection must never be forceful as a wrong line of cleavage may lead directly into the rectum. It is well to realize that the sides of the rectum are less vulnerable than the mid-surface anteriorly to which the attachments of the genito-urinary structures run. As little disturbance of these as possible is desired; therefore, one often can work to advantage from the sides toward the middle. Gentle pressure on the anterior rectal surface externally with the index finger puts these levator ani fibers that run anteriorly to fuse with the genito-urinary layer of muscles on the stretch almost as effectively as an anterior retractor. Anterior retraction, when used, should never be forceful as it may injure the constrictor urethræ. Division of these recto-urethralis fibers brings the dissection to the apex of the prostate, and the beginning of the backward bend of the rectum (Fig. 4). Rectum and prostate are here in close apposition as is so evident on finger palpation per rectum, but are separated by a transverse fascial sheath, a part of the rectovesical layer (Fig. 7), known to urologists as that of Denonvillier, that is attached to the triangular ligament at the apex of the prostate and spreads out fanwise over prostate and seminal vesicles to unite above with the peritoneum that dips down between the bladder and rectum.

This *fascia of Denonvillier* is the second important sign post of the operation, as incision of it at the

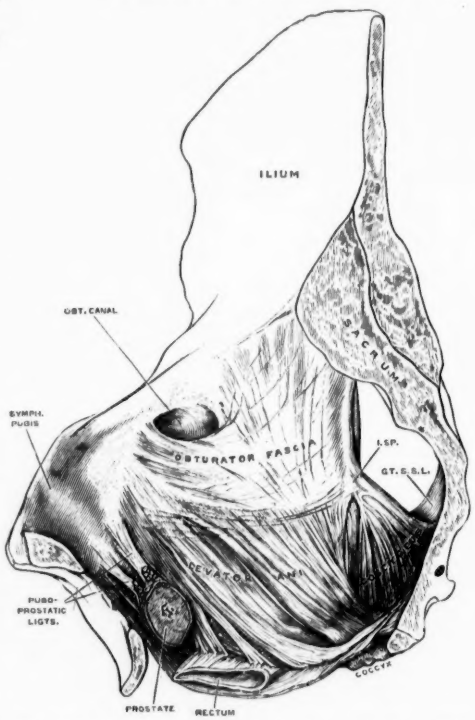

Fig. 6. Diagrammatic representation of the pelvic diaphragm formed by the levator ani and coccygeus muscles. The few fibers of the levator ani attached to the anterior rectal surface are illustrated, coursing just behind the prostate. (From Quain's *Anatomy*, vol. iv, pt. 2, 1923, Fig. 71.)

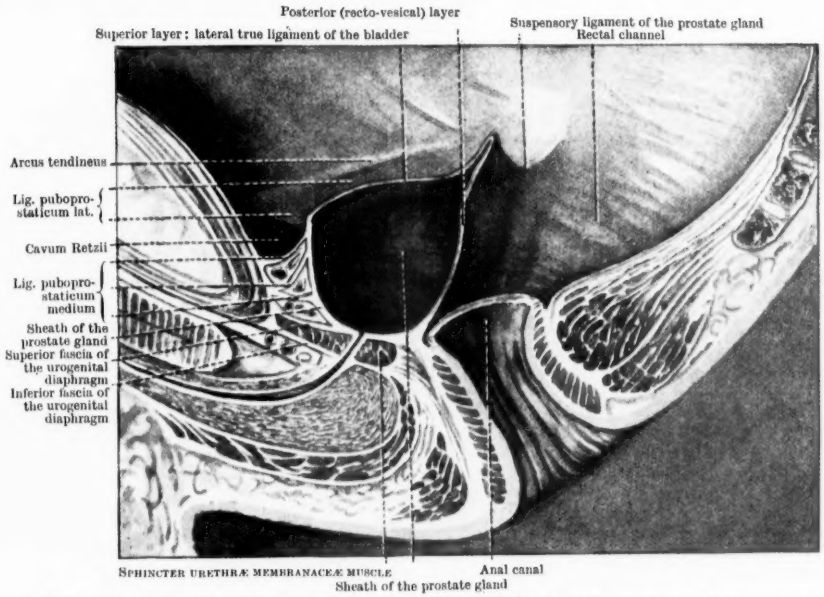
Posterior (recto-vesical) layer
Superior layer: lateral true ligament of the bladder
Suspensory ligament of the prostate gland
Rectal channel
Arcus tendineus
Lig. puboprostaticum lat.
Cavum Retzii
Lig. puboprostaticum medium
Sheath of the prostate gland
Superior fascia of the urogenital diaphragm
Inferior fascia of the urogenital diaphragm
Sphincter urethræ membranaceæ muscle
Anal canal
Sheath of the prostate gland

Fig. 7. A more or less diagrammatic representation of the fascial coverings of the prostate, which shows the posterior (rectovesical) layer generally called the fascia of Denonvillier, the splitting of which enables separation of the rectum from the prostate. (Cunningham's *Anatomy*, 4th ed., 1913, Fig. 435.)

proper line of cleavage permits a quick, easy, and safe separation of rectum and prostate, which straightens the flexura perinealis recti and fully exposes the whole posterior prostatic surface.

The trail Young blazed so thoroughly by these two sign posts—the central point of the perineum and Denonvillier's fascia—is traveled in his footsteps by most surgeons, although one minor short cut, proposed by John T. Geraghty and the writer at about the same time, is now recognized as safe. These steps with comments from personal experience will be presented but briefly as they are fully outlined and profusely illustrated in many textbooks and recent surgical magazines.

The position of the patient may be a not inconsiderable help in the dissection of a difficult perineum. I still use Halsted's perineal board and place the patient on it with legs so flexed that the perineum is almost parallel with the floor (Fig. 8).

For the last 8 years I have been passing Young's seminal vesicle tractor (Fig. 9) or Geraghty's tractor (Fig. 10) into the deep urethra, where it is held closed by an assistant, in place of a urethral sound. Later it can be slipped through into the bladder, the blades opened, and then used as a tractor to lift the prostate up in the perineal field (Fig. 11).

The incision of the perineum can be too high and it can be too low. It can also be too small. It starts on a level with the anus just inside the ischial tuberosity, arches up across the raphé one and one-half inches above, and ends at a corresponding point on the opposite side (Figs. 12 and 13).

The ischiorectal fossa on each side is opened up between transversus perinei, levator ani, and rectum by blunt left index finger dissection against the scalpel handle in the right hand (Figs. 5 and 14), and Young's posterior bifid tractor is inserted. The conjoined tendon of the anal sphincter is divided (Fig. 15), thus exposing the attachment of levator ani fibers to rectum and the genitourinary layer of muscles (Figs. 16 and 20). *These rectogenital and recto-urethralis fibers* are next divided, exposing the apex of the prostate. It is important that this dissection does not injure the transversi perinei which carry important nerves and blood vessels to the structures between the triangular ligaments including the constrictor urethræ (Fig. 18). The seminal vesicle tractor is pushed into the bladder and opened. By traction and gently prying against the symphysis with its shaft the prostate is lifted by the open blades into the field but against the rectum. The rectum is

Fig. 8. Photograph illustrating the extreme lithotomy position used for perineal prostatectomy. It is seen that the perineum is almost parallel with the floor.

Fig. 9 (left). Photograph of Young's seminal vesicle tractor which is passed closed into the urethra in place of a sound and then can be pushed on into the bladder after the apex of the prostate has been reached in the perineal dissection, and when opened (Fig. 11) the prostate can be lifted well up into the operative field, to facilitate the separation of the rectum on the line of Denonvillier's fascia.

Fig. 10. Photograph of Geraghty's prostatic tractor. In some instances with the patient in extreme lithotomy position the straight tractor cannot be easily inserted. In these cases, Geraghty's tractor, which has a urethral curve, is substituted.

still between the examining finger in the perineum and prostate which nevertheless is distinctly palpable. By blunt and scalpel dissection at one or the other side of the prostate and away from the rectum, *the proper line of cleavage on Denonvillier's fascia* is found and followed across the middle to the other side, freeing the rectum from the prostate (Fig. 17). Often an anterior tractor to lift the bulb and put the triangular ligament on the stretch is not required. Where the prostate and rectum are particularly adherent, freeing them in the mid part is not necessary as the incision of the posterior lobe can curve across the apex of the gland from one side to the other and the adherent rectum will drop out of the way attached to this flap of the posterior lobe. The membranous urethra has been neither denuded nor disturbed by the above procedure. The prostate has been exposed similarly to perineal exposure of the seminal vesicles in the operation of seminal vesiculectomy (Fig. 11).

The important steps to secure good exposure for perineal prostatectomy, therefore, are (1) position of the patient, (2) incision of the perineum, (3) freeing of the rectum to the apex of the prostate by separation of the genito-urinary and anal layers of perineal muscles, (4) lifting the prostate by an instrument *per urethram* into the field, and (5) exposing its whole posterior surface in the line of cleavage of Denonvillier's fascia.

Enucleation. Six of the seven portions or lobes of the prostate may undergo hyperplastic changes, the posterior lobe alone being immune. The common types are various combinations of lateral, middle, and anterior lobes. Rarely do subcervical or subtrigonal enlargements occur. Most urologists prefer to make a cystoscopic study before prostatectomy, but this study becomes a necessity before removal perineally, for it is of considerable importance to have diagnosed cystoscopically the particular combination requiring removal as well as possible complications, such as vesical stone and diverticulum (Fig. 19). There are several incisions of choice of the posterior lobe for purposes of enucleation. Young's original contribution was designated conservative because he preserved not only the external sphincter, commonly injured in so-called median perineal prostatectomy, but also the ejaculatory ducts to which previously no attention had been paid. This latter was accomplished by making lateral incisions and thus preserving the ducts and verumontanum in the bridge of tissue between (Fig. 21). By this method the various lobe enlargements are enucleated separately. It is ideal for bilateral hyperplasia. But when lobes are confluent or ring type complete enucleation is sometimes difficult, smaller nodules being easily overlooked, or when the enlargements are of size they must be removed in pieces, thus endangering the completeness of the procedure, otherwise the middle bridge will be torn and mutilated. This is no great disaster, but in most cases cleaner, more complete enucleation is facilitated by the inverted V incision (Fig. 22) which also preserves the verumontanum and ducts but by which, in addition, a good open exposure of the

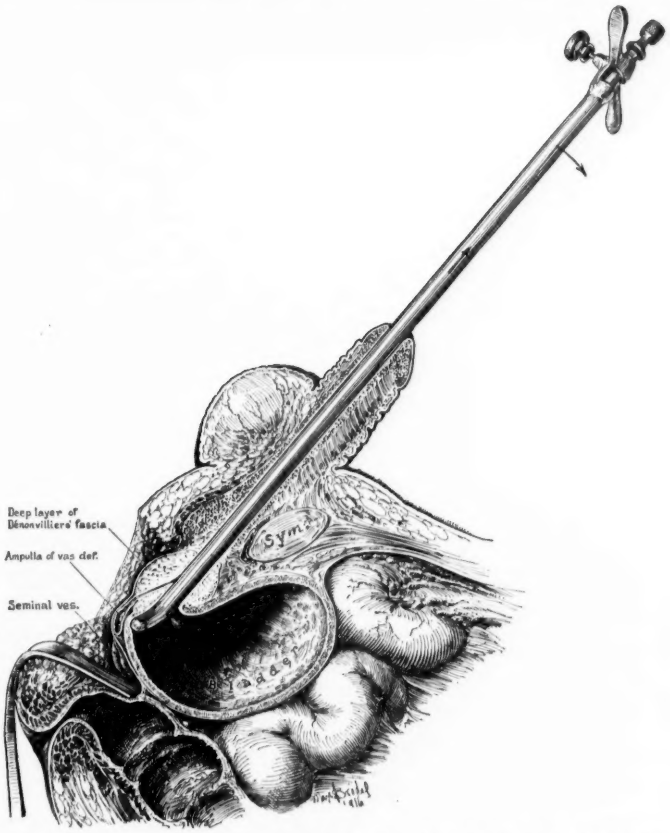

Fig. 11. A drawing that illustrates how the vesical tractor, by prying against the symphysis, lifts the prostate well up into the operative field. (From Young's *Urology*, vol ii, Fig. 883.)

hyperplastic portions of the gland is secured, through which the entire mass can be shelled out intact under the direct control of eye and hand (Fig. 24, frontispiece). The particular precautions at this stage are complete removal with preservation of the ejaculatory ducts and internal sphincter. The ejaculatory duct idea perhaps is too fixed and overdone in most cases. Particularly unimportant is it in those old men on whom vasectomies have been done. But in younger patients not thus protected against epididymitis and in whom restoration of the tract to as near normal as possible is desired, the preservation of the verumontanum with its ducts is of considerable importance. This very precaution also minimizes the danger of postoperative epididymitis. Preservation of the internal sphincter is easily accomplished by stripping it back with finger or dissecting scissors as the hyperplastic mass is freed and delivered. The advantages of the open flap method are better exposure and *en masse* enucleation. The redundant layers of mucosa of prostatic urethra and bladder neck left denuded by the enucleation can be trimmed cleanly with the bladder neck so that no obstructing or irritating tags are left. Visual inspection of the cavity and the neck is improved for cleaning it as well as ligature of bleeding points. It is well to attach one or more clamps to the rim of vesical mucosa that is formed by the division of the mucosal funnel in the final step of detachment of the hyperplastic mass, to prevent its being pushed back into the bladder later and then being the source of vesical hæmorrhage that is hard to control or, even

Fig. 12.

Fig. 12. Photograph of incision of perineum. The fingers of the operator rest just inside the ischial tuberosity from and to which the curved incision goes (Fig. 13).

Fig. 13.

Fig. 13. Photograph of incision of perineum curved across from ischial tuberosity to ischial tuberosity.

Fig. 14.

Fig. 14. Photograph of the method of blunt finger dissection into the left ischiorectal fossa, the route taken by the finger being illustrated diagrammatically in Figure 5. The finger must enter the space just below (dorsal) the transversus perinei, never above (anterior).

Fig. 15.

Fig. 15. Photograph illustrating the first step toward separation of anal and genito-urinary muscle layers by the division of the conjoined tendon of the anal sphincter. The blades of the bifid tractor are shown passing into the ischiorectal fossæ above the rectum on each side of this conjoined tendon.

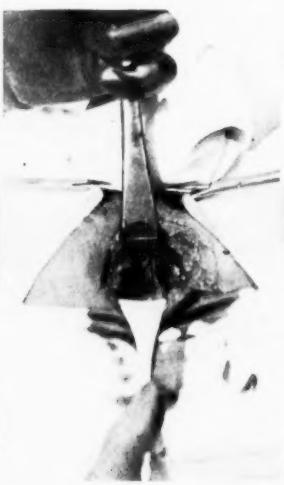

Fig. 16.

Fig. 16. Photograph of a still deeper dissection than shown in Figure 20. The seminal vesicle tractor can be palpated through these fibers that have been placed on the stretch by the two tractors. Dissection still follows the rectum as closely as possible.

Fig. 17.

Fig. 17. Photograph showing the posterior prostatic surface from which the rectum has been separated on the line of cleavage of the fascia of Denonvillier and which is held well up in the perineum by the seminal vesicle tractor that has been inserted into the bladder and opened. The membranous urethra with its external sphincter has not been denuded nor disturbed.

when slight, produces clots that plug the catheters and trouble postoperative care. A possible disadvantage is predisposition to stricture in the course of restoration of the prostatic urethra inasmuch as the whole of the prostatic urethra is removed with the periurethral hyperplasia. A con-

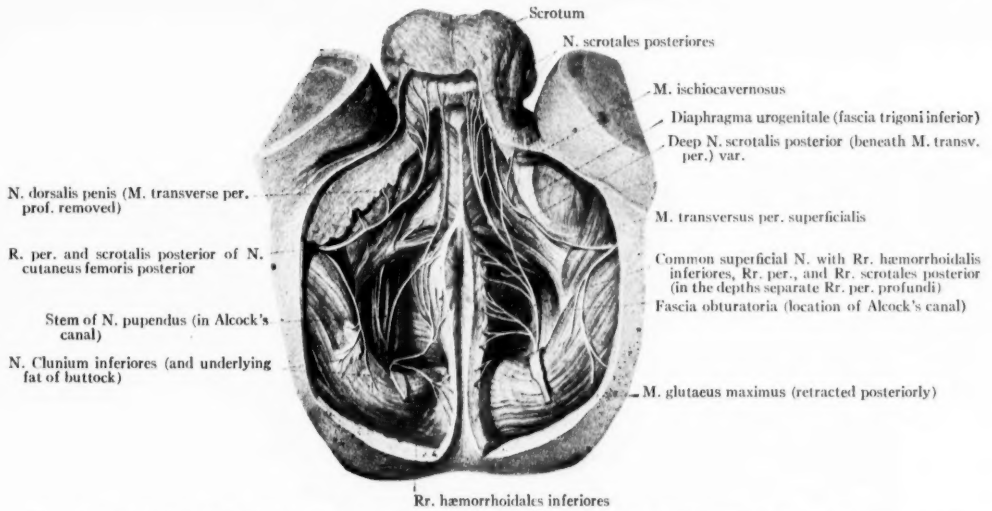
Scrotum
N. scrotales posteriores
M. ischiocavernosus
Diaphragma urogenitale (fascia trigoni inferior)
Deep N. scrotalis posterior (beneath M. transv. per.) var.
N. dorsalis penis (M. transverse per. prof. removed)
M. transversus per. superficialis
R. per. and scrotalis posterior of N. cutaneus femoris posterior
Common superficial N. with Rr. hæmorrhoidalis inferiores, Rr. per., and Rr. scrotales posterior (in the depths separate Rr. per. profundi)
Fascia obturatoria (location of Alcock's canal)
Stem of N. pupendus (in Alcock's canal)
N. Clunium inferiores (and underlying fat of buttock)
M. glutaeus maximus (retracted posteriorly)
Rr. hæmorrhoidales inferiores

Fig. 18. A drawing that illustrates the importance of not injuring fibers and vessels that pass along the transversus perinei to the genito-urinary layer of muscles and also the importance of hugging the rectal wall in the dissection of the prostate. (From Braus, *Anatomie des Menschen*, vol. ii, 1924, Fig. 243.)

striction at the neck is not uncommon after suprapubic enucleation by which the prostatic urethra is likewise divulsed. The writer has seen four such postoperative suprapubic cases but only in one of his own perineal cases does he know of such constriction. This was a patient with a small fibrous hyperplasia in whom the urethral catheter came out on the second day and urination was re-established so satisfactorily that it was never replaced. As a routine the urethral catheter, placed at operation as a guide to the reformation of a prostatic urethra upon the same principles as after external urethrotomy, is retained 6 to 7 days. During this time gentle suction is used so as to keep the perineum dry, and quick healing is the rule.

The important steps of enucleation are (1) incision of the posterior lobe, bilaterally, if the enlargement is small and two-lobed, otherwise by an inverted curve; (2) preservation of verumontanum and ejaculatory ducts in patients not vasectomized; (3) replacement of the urethral tractor by the short prostatic tractor, passed into the bladder through the prostatic urethra opened up by one of the lateral incisions or by the curved incision, so as to give more direct traction (Figs. 23 and 24, frontispiece); (4) complete clean removal of all the hyperplasia; (5) preservation of the internal sphincter; and (6) treatment of the redundant prostatic and vesical mucosa so as to leave no tags or bleeding points.

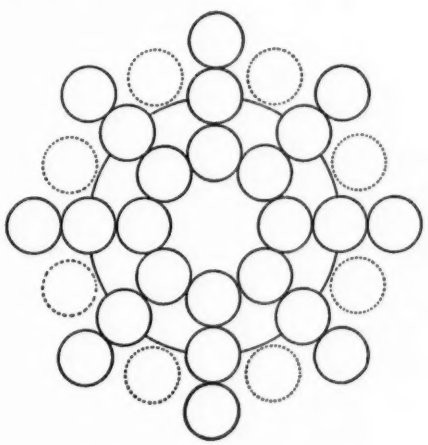

Fig. 19. Chart in use for recording findings at the time of cystoscopy and by which the exact type of hyperplasia may be indicated. The three circular rows of eight views are for the near, mid, and far positions of the cystoscope with respect to each, the views of course often changing markedly according to whether the cystoscope is elevated so as to bring the vesical neck near the field or whether it is depressed so as to bring it at some distance away. By this sort of manipulation the position of the shaft in the right or left sulcus of the middle lobe can readily be demonstrated. The dotted circles are for the purpose of recording changes of view for any one position with such manipulation. (See Hinman: Chart for recording cystoscopic examinations. J. Urol., 1918, ii, 433–444.)

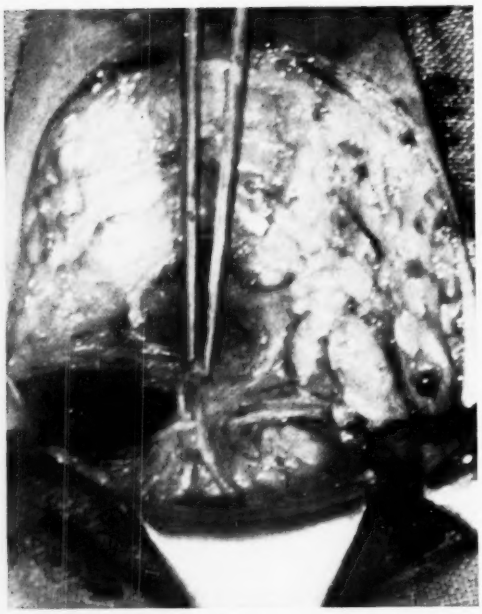

Fig. 20. Photograph illustrating the muscle attachments of the rectum to the genito-urinary layer of muscles placed on the stretch by the posterior and anterior tractors. These muscle attachments are divided by the scalpel as closely as possible to the rectal wall so as to avoid injuring the important nerves and blood vessels that pass to the central point of the perineum in the transversus perinei muscles and their fascia (Fig. 18). The central point of the perineum is held in the tissue forceps and it is seen that the transversus perinei in the illustration are a little asymmetrical.

Repair with hæmostasis. The restoration of a good urethra with complete continence is secured only when exposure and enucleation have been done successfully. But the surgical danger of prostatectomy is hæmorrhage and methods to control this necessarily influence the processes of repair. Undoubtedly those cases which do not bleed heal best. Often bleeding points can be seen and ligated but it is rarely safe to rely on this alone, for hæmostasis and the wisdom of taking 20 to 30 minutes more to do this and then have to pack probably is questionable. I am by no means so optimistic as one of my recent associates who recommends this as a possible successful routine of the future.[1] Most cases require either packing or hæmostatic bag or both. In order to disturb repair as little as possible the bag can be small and the packing largely one of outside infra-

[1]Gibson, Thomas E. Improvements in perineal prostatectomy permitting primary wound closure and healing without drainage. Surg., Gynec. & Obst., 1928, xlvii, 531–539.

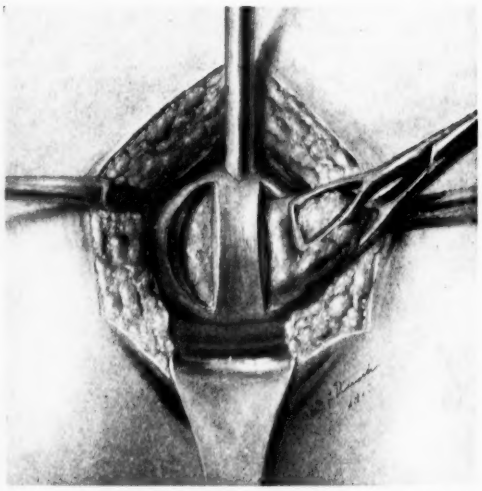

Fig. 21. A drawing that illustrates the method of bilateral enucleation by Young's original method which preserved the bridge of prostatic tissue carrying the ejaculatory ducts. (From Young's *Urology*, vol. ii, Fig. 806.)

prostatic compression against this bag. The most troublesome place of hæmorrhage is that from the neck, which is hard to control by packing and which fills the bladder with clots. All points of bleeding at the neck that can be located should be ligated by suture. This accomplished within a reasonable period, the urethral catheter, above referred to, is placed, the inverted V flap of the posterior lobe sutured in place by two or three mattress sutures, and the perineum closed. An infraprostatic pack may be placed for compression of the prostate and obliteration of the cavity of enucleation. Where bleeding cannot be controlled by suture and ligature, as is usual with enlargements of size, a special mushroom catheter made by Eynard[2] is passed through the perineum on a special stylet into the bladder (Figs. 25 and 26).[3] Traction on it will compress the neck and the prostatic cavity can be lightly packed against it to control bleeding, or, as in most cases, an infraprostatic pack can be placed outside of the prostate for compression. As material for packing I prefer the gauze-protective ribbon (strip of gauze sewn between two layers of protective tissue, Fig. 27) of Charnock[4] because its removal is less painful and it is less apt to stir up hæmorrhage by not being adherent.

[2]For Bard and Company of New York.

[3]This type of bag, which can be obliterated by stylet for removal is preferred to the very efficient one of Davis because of size only.

[4]Charnock, Donald A. A non-elastic rubber strip drain. J. Am. M. Ass., 1929, xcii, 982–983.

Fig. 22 (left). Photograph of V-shaped incision of the posterior lobe of the prostate which also leaves a bridge of tissue carrying the ejaculatory ducts so that they can be preserved and which has the added advantage that a wide open exposure of the hyperplastic portions to be enucleated is secured. Tissue forceps are seen to grasp the apex of this V bridge and the scalpel points to the hyperplasia bulging through the incision.

Fig. 23. Photograph taken with the V bridge held posteriorly so as to expose the seminal vesicle tractor in the prostatic urethra. At this stage this tractor is withdrawn and the short prostatic tractor of Young inserted so as to give more direct and better control of traction for enucleation.

The important steps of repair are (1) control of hæmorrhage by suture or ligature, (2) urethral retention catheter, (3) special perineal catheter for compressing the neck so placed that the redundant mucosa is not everted, (4) small prostatic (gauze-protective) pack, only when necessary, (5) suture of V flap of posterior lobe incision into place, on both sides if no bleeding and neither tube nor pack used, on one side with tube and pack issuing at other when used, (6) infraprostatic pack when indicated, and (7) closure of perineum.

THE TEACHING OF PERINEAL PROSTATECTOMY

Theoretically the perineal route has many points of superiority over the suprapubic but it never has been popular because of the difficulties of technique. It used to be said the one is hard on the doctor but easy on the patient whereas the other is easy on the doctor but hard on the patient. Too distressing are the evidences of failure for one to persist in attempts to master the details of technique when another route that is easy and as a rule kills or cures is at hand. No longer is there enough difference in mortality to stimulate more than a few to make the effort. With few exceptions the men trained by Young and those trained by them are the practitioners of perineal prostatectomy. There can be no question but that suprapubic prostatectomy is superior to median perineal prostatectomy still practiced in many foreign clinics and the literature has been unfair to Young's operation because of comparisons based on this operation. Before 1903 there were only three American and eight foreign references to perineal prostatectomy (*Index Medicus*); from 1903 to 1915 there were 145 articles published by foreigners to 98 by men in the United States; whereas during the last 12 years there have been 66 American publications as compared to only 22 foreign and many of these latter were reports on a few cases, no large series. This is evidence that the operation is now relatively unpopular abroad. The reason would seem to be the fact that Young's operation is the only one that equals or betters the after results of suprapubic removal, and Young's methods have not been followed. A glance at the American articles of recent years shows numerous modifications (by Cecil, Crowell, Davis, Dillon, Geraghty, Hinman, Lowsley, Lydston, Morrissey, Ochsner, Gibson, and Young) endeavoring to simplify the technique, make it safe from rectal or sphincteric injury, and improve certain surgical principles such as hæmostasis. In

Fig. 25. Photograph of special mushroom catheter for drainage and for traction against the vesical neck to control bleeding. The stylet is shown with a small wire eye at its end which is threaded on to the suture that passes through the lumen of the catheter from its tip so as to guide the end of the stylet securely into the end of the catheter for its removal (Fig. 26).

Fig. 26. The stylet has been inserted so as to eliminate almost completely the bulb part of the catheter.

all fairness to the originator, most of these modifications of Young's classical method are of minor importance and in fact many of them had been previously used or tried out by him independently. If these objects are attained, perineal prostatectomy will continue to rival the suprapubic operation, but probably never will replace it. Its superiority would have to grow considerably for this to happen. The necessary apprenticeship beyond the reach of the majority is a factor in its survival that must be recognized. Rarely has a perinealist been self-taught. The life of perineal prostatectomy depends on inbreeding. And yet every perinealist must win his spurs by individual effort. Spoon feeding won't work. In addition it must be recognized that with improvements in preparation and after-care the suprapublic route has also become a much more benign operation than it was 20 years ago. When performed by the open method and with proper attention to hæmostasis, it becomes a worthy opponent of its more surgical rival. But judging by published statistics the perineal route has held and still holds the lead for benignancy, the relative figures being about as 3 to 6. In other words, the perineal route will save at least three men in every hundred that would be lost suprapubically in the hands of those most experienced with each method. Taken at large the difference would be as about 5 to 15, but no doubt many of the 10 survivors of perineal surgery done by the casual operator would rather be dead. Perineal prostatectomy is not to be attempted lightly. In spite of the higher mortality, the suprapubic is the operation for the occasional operator.

This difference in surgical risk alone is worth an effort and explains the persistence of a few surgeons in taking the perineal risks of after trouble that could be largely avoided by going suprapubically. But it must be understood in all fairness to the subject under discussion that functional results suprapubically are by no means one hundred per cent perfect. Far from it. The problems of complete enucleation and of repair with hæmostasis are just the same, only with this difference —the perinealist has the advantage of better exposure and more direct access to meet them. If certain of non-injury to the rectum and constrictor urethræ all urologists no doubt would at once become perinealists.

The big question of interest to all, therefore, is whether the principles of preserving the rectum and the urethral sphincter can be taught and handed down from generation to generation, since this is the only way perineal prostatectomy will survive. That the first generation has carried on successfully is proved by the medical literature of recent years, remarkably low mortalities of good sized series being reported by some of Young's pupils. To test the second generation in a small way a questionnaire was mailed to the small group of men now practicing urology who have had their training under me. Their answers have been summarized elsewhere.[1] As further evidence of the practicability of training these men the results

Fig. 27. Photograph illustrating the type of protective gauze ribbon used for packing.

[1]The Teaching of Perineal Prostatectomy. California State Medical Meeting, May 7, 1929.

of prostatectomy operations performed by 14 of them at the City and County Hospital while in training have been studied. Each one served at least 6 months as chief of this service after 2 or more years apprenticeship as an assistant, and each one performed from 2 to 11 perineal prostatectomies. The results of 70 operations by these 14 men are presented in combination with their answers. It may be said here that all of these men but one prefer the perineal route.

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FROM THE DEPARTMENT OF GYNECOLOGY, NORTHWESTERN UNIVERSITY

DELIVERY OF THE UTERUS

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INCREASED interest in the study and treatment of lesions of the cervix has impressed upon all of us the frequent inaccessibility of this organ. This may perhaps account for the high incidence of unsatisfactory results following cervix operations. The range of mobility of the uterus has always been accepted to be relatively limited except in patients with undue relaxation of the supports; as a matter of fact, *with proper leverage upon the bases of the broad ligaments a surprising degree of mobility can be obtained.*

The object of this communication is to present a method of delivery of the uterus to the vulvar orifice or beyond—a procedure easily accomplished in nearly all patients except in the presence of far advanced cancer or unusual instances of inflammatory fixation.

The anterior lip of the cervix is grasped, the uterus is pulled downward as far as possible, and a bullet forceps "bites" deeply into the base of the left broad ligament where it joins the uterus (Fig. 1). The cervix is now drawn toward the left and the right broad ligament deeply grasped by another forceps. Repeated "bites" may be required before a satisfactory grip is obtained in the broad ligaments (Fig. 2). The two bullet forceps, as now applied upon the base of each broad ligament, (assisted, if desired, by the anterior lip forceps), serve as *levers* which deliver the uterus to the vulva or beyond (Fig. 3).

Increased accessibility of the cervix is a distinct asset in the diagnosis of suspected malignancy and in the study of various other cervical and endocervical lesions; in treatment, it greatly facilitates the introduction of radium needles, simplifies the employment of surgical diathermy, and is of great help in various cervical operations.

I have employed "delivery of the uterus" for approximately 15 years. In my earlier experience it appeared too simple to merit publication. With the passage of time, however, the scope of its usefulness has become immensely broadened until we now feel that it is one of our most valuable assets in operative technique. Recognition of the difficulties encountered even by skilled gynecologists in a considerable proportion of operations upon the cervix impels me to advocate more general use of this measure.

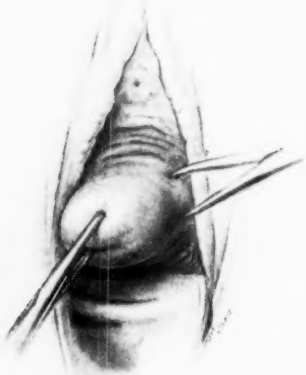

Fig. 1.

Fig. 2.

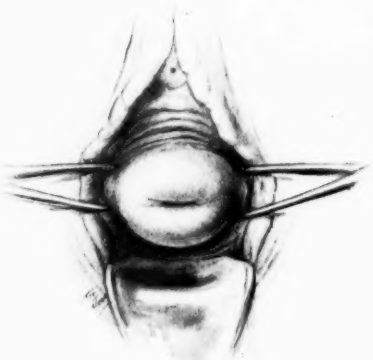

Fig. 3.

Fig. 1. The anterior lip of the cervix is grasped, the uterus is pulled down as far as possible, and a bullet forceps "bites" deeply into the base of the broad ligament where it joins the uterus.

Fig. 2. Semidiagrammatic illustration of application of bullet forceps to the bases of the broad ligaments.

Fig. 3. The two bullet forceps serve as levers which deliver the uterus to the vulva or beyond.

PNEUMARTHROSIS OF THE KNEE

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THE injection of oxygen into joints as an additional aid to diagnosis is worthy of wider use than it now is given. It is preferable to replace the generic diagnosis of an internal derangement of the knee joint with a specific diagnosis as: loose internal or external semilunar cartilage; rupture of the crucial ligaments; injury to the external or internal lateral ligament; loose body in the knee joint, etc. The use of pneumarthrosis will give more accurate pre-operative diagnoses, and make operative procedures definite rather than exploratory and the less the tissues of a joint are handled and manipulated, the more rapid will the postoperative recovery be, while postoperative pain, discomfort, and the possibility of infection are reduced to a minimum.

The history of cartilage derangement is often clear cut: an injury followed by locking of the joint, swelling, localized pain, and tenderness. Any of these more or less classical symptoms may be absent. In Case 3 of this series, the patient stated that the condition in both knees had recurred so often that he did not know the number of times, and when asked if there was ever an inability to straighten the leg he answered "no." The examination, however, showed a ten degree flexion deformity and an appreciable increase of fluid in the joint.

The usual roentgenogram of a normal knee in the anteroposterior view shows a clear space between the tibia and the femur. The normal semilunar cartilages closely approximate the tibia and are not usually distinguishable by the X-ray. If a cartilage is loosed and oxygen is injected in the joint, the cartilage is raised and surrounded entirely or partially by the gas. The cartilage may then be demonstrated by X-ray according to Kleinberg as an area of density, above and below, which is a dark almost black line, the oxygen. In all of Kleinberg's cases the internal cartilage was affected; in the cases reported here, the external cartilage. The findings in these cases differ, therefore, in that the cartilage was visible in the interval between the tuberosity of the tibia and condyle of the femur, as a shadow about 3 millimeters in diameter, of lesser density than the bone. The oxygen as a dark line was visible in every case between the cartilage and the femur but not beneath the cartilage. The X-rays also showed the capsule of the knee joint very satisfactorily and demonstrated the attachment of the internal cartilage thereto. The oxygen distended and pouched out the internal lateral ligament above and below the inner cartilage, but the shadow of this cartilage itself was not seen as there was no pathological change in the inner meniscus. On the outer side the capsule and external lateral ligament are not attached to the cartilage; the dark shadow of gas, therefore, was uninterrupted. The lateral views in all the plates were negative, but showed the distended quadriceps bursa and the posterior capsular ligament. These are seen in the accompanying Figure 1.

A sterile tray is prepared in the operating room. On this are placed articles for scrubbing the hands; gloves; towels; iodine; a rubber tube with a glass connecting tip; several needles of fairly large bore, 2.5 inches long; a hæmostat, 2 per cent novocain; and a hypodermic syringe. An ordinary tank of oxygen is used, the gas passing through the wash bottle to cleanse it. The knee is previously given a two day preparation as for an open operation. The injection is made in the X-ray room on the X-ray table.

An assistant turns on the gas. The rate of flow is such that when the needle attached to the tank by a rubber tube is held close to the face, a gentle pressure is felt.

TECHNIQUE OF THE INJECTION

The operation takes but a few minutes. The patient is placed upon the X-ray table, the knee painted with tincture of iodine (half strength), draped, and an X-ray plate placed beneath it. A 2 per cent solution of novocain is injected below the patella and to the outer side of the patellar tendon. The patella is lifted and the needle is introduced into the joint so that the tip is beneath the center of the knee cap. If an external cartilage injury is suspected, it is better to introduce the needle from the inner side so as not to obscure the cartilage. The oxygen is allowed to flow into the joint until it is moderately distended. A hæmostat is then placed on the tube, the flow of gas stopped, the tube disconnected from the tank, and the anteroposterior view taken. The patient turns on his side and lateral views are made. The hæmostat is then removed and the knee deflated. The needle is removed and a collodion dressing applied. A circular sheet wadding and flannel bandages are applied for compression and worn for 3 or 4 days when the remaining gas is entirely absorbed.

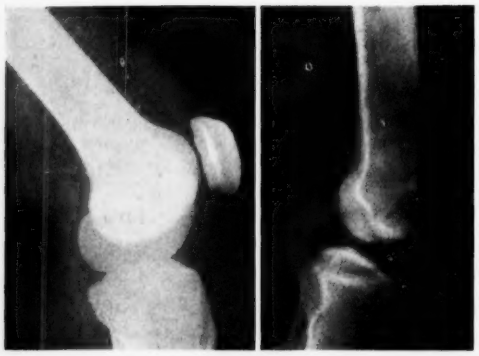

Fig. 1. Lateral views of the knee before and after oxygen injection. Right, the dark area indicates the oxygen distending the quadriceps bursa and lifting the patella. The shadow is confined posteriorly by the outpouching of the posterior capsular ligament.

When the joint is distended there is always some discomfort, but only one patient complained of considerable pain. When the joint is deflated the discomfort ceases. None of the patients had postoperative pains.

Herewith are reported 4 cases, five external cartilages being treated as both knees were involved in one patient. The X-ray examination after oxygen injection and the operative findings will show why an affected cartilage demonstrable on the operating table may not be shown by the X-ray, even with the aid of pneumarthrosis, and also why X-ray interpretation may arouse suspicions or even be negative. X-ray examination with pneumarthrosis is not pathognomonic; it is only one factor in diagnosis.

OPERATIVE TECHNIQUE

The anæsthetic used was nitrous oxide and oxygen. A tourniquet was applied and the knee flexed to 150 degrees to give the best exposure and make the cartilage more accessible. Asepsis was carefully observed and the wound edges were protected with gauze. A straight incision about 3 inches long was made parallel with the outer side of the patellar tendon. This incision made the removal of the cartilage somewhat more difficult, but it caused less strain after operation, active motion was started early and the patients were allowed out of bed sooner without fear of weakness in the knee. In each case the wound healed by primary union and the convalescence was uneventful.

CASE REPORTS

Case 1. Anna B., aged 21 years, school teacher. The patient was well until August 29, 1926, when she fell from a fence rail about 28 inches above the ground, the knee being flexed beneath its fellow. She had immediate severe pain and was carried home. She was in bed for 2 weeks and treated with local applications. The inner side of the knee was very painful and the slightest motion and weight bearing were impossible. The patient was given a gas oxygen anæsthetic and a physician attempted to reduce a dislocated cartilage. The patient remained in bed for 10 days when she walked with crutches and later a cane until the end of October. At no time since the accident was she able to straighten the knee although the swelling gradually subsided and she suffered no pain since the attempted reduction.

Fig. 2 Case 1. Left, the clear area between the condyles of the femur and the tuberosities of the tibia is seen. Right, the oxygen may be seen as a black shadow between the inner condyle and tuberosity, and the prominence of the outer cartilage is shown as a shadow of lesser density. The quadriceps bursa is distended by the oxygen and the needle is seen beneath the patella.

Examination on December 3, 1926, showed a slight atrophy (one-half inch) of the right calf and thigh. There was a one-quarter inch swelling, more marked on the inner side of the knee, with a slight increase of fluid in the joint so that when the quadriceps bursa was compressed the patella floated. Extension was possible to 170 degrees; flexion was unrestricted. There was pain on pressure over the external cartilage, but no grating on motion. The patient had a marked degree of weak feet. X-ray plates were negative.

A tentative diagnosis of derangement of the external semilunar cartilage was made. The symptoms and subjective findings were on the inner side of the knee; and the objective findings were of an injury on the outer side. For this reason pneumarthrosis was suggested.

On June 27, 1927, injection into the right knee caused but slight discomfort to the patient when the joint was inflated. X-ray showed a prominence of the external semilunar cartilage suggestive of displacement, and it is here pictured (Fig. 2). The lateral ligament was plainly visible outside of this shadow; the internal lateral ligament was visible on the opposite side.

At operation on July 6, 1927, a 3 inch vertical incision was made. The cartilage was divided and removed and appeared normal except that it was moderately loose. The knee could not be straightened, and inspection and instrumental palpation disclosed a foreign body closely attached to the posterior spine of the tibia. A small particle of bone

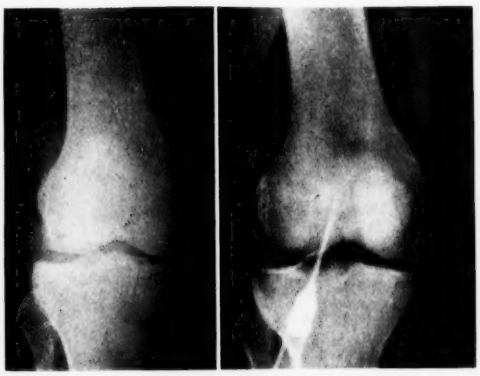

Fig. 3. Case 2. Anteroposterior view of the knee. Left, the clear space between the femur and tibia may be seen. Right, the shadow between the outer condyle of the femur and the tuberosity of the tibia is the external semilunar cartilage. The dark shadow of oxygen at the outer third of this cartilage indicates the line of fracture. The oxygen distends the joint showing the capsule and demonstrating the attachment of the internal cartilage to the capsule and that the outer cartilage is not attached to the external lateral ligament.

covered with fibrous tissue was removed which did not show on the X-ray plates. Complete extension was then possible and the wound was closed in layers. Through another incision the inner cartilage was inspected because of the symptoms referred to this side of the joint. It was firmly attached and appeared normal. The wounds healed by primary union and the recovery was uneventful. Two months later the patient resumed her occupation as a teacher and has since remained well.

Case 2. Rose G., aged 18 years, stenographer. Two years age the patient fell and sprained her right knee. She limped for a day and was better until 3 months prior to this examination, when she had a dull ache at either side of the right knee both at rest and on exertion, but there was no limp. X-rays were negative.

Examination on May 24, 1927, showed a slight swelling and an increase of fluid in the right knee, but not enough to cause the patella to float when the quadriceps bursa was compressed. Extension was restricted by 5 degrees. There was no grating on motion. Pressure over the origin and insertion of the external lateral ligament caused pain, but there was no pain on pressure over the external cartilage. Lateral motion of the leg on the thigh caused no discomfort. The soft tissues on either side of the patellar ligament or about the knee were not thickened. The patient had a mild knock knee deformity.

A provisional diagnosis was made of injury to the right external lateral ligament of the knee with a possible injury of the external semilunar cartilage. The patient was advised to rest the knee, wear a web knee cap, and apply hot applications once or twice a day. After 4 weeks no improvement occurring, oxygen injection for diagnosis was advised and done on June 25, 1927. The patient complained of severe pain when the knee was distended with gas, but this was relieved as soon as the part was deflated. X-ray examination showed what appeared to be a dislocated external semilunar cartilage. While the condyles were not much farther apart than usual, there was an increased

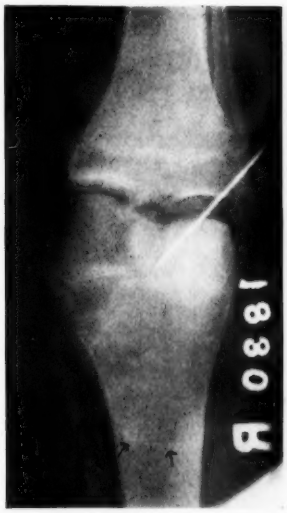

Fig. 4. Case 4. The external semilunar cartilage, slightly displaced outward. is seen in the outer intra-articular area. The oxygen has ruptured the quadriceps bursa and may be seen above the bursa as a dark shadow in the tissues and to either side of the femur.

thickening of lesser density than the bone at the posterior part of the external condyle.

Further examination of the films showed a transverse fracture of the external cartilage at the junction of its outer third with the inner two-thirds. This is shown in Figure 3. The oxygen appeared black in the line of fracture of the cartilage. Operation was advised.

On July 11, 1927, a 3 inch vertical incision was made, the synovia incised, and the cartilage seen to be apparently normal. It was divided and the inner half removed. The outer half was dissected from its attachment, and at the junction of the outer fourth with the inner three-fourths a transverse fracture of the cartilage was found. When the knee was flexed the posterior fragment of the fractured cartilage slipped back into the joint, acting as a loose foreign body which prevented full extension. This fragment was excised and the wound was closed in layers.

The convalescence was normal until the sixth day when the temperature gradually rose to 102 degrees, and the pulse to 120. The white count was 12,250 with 84 per cent polymorphonuclear cells. The patient felt well except that she was drowsy. Physical examination was negative, the wound healed by primary intention and appeared at no time responsible for her symptoms. In a week the untoward symptoms subsided, and the convalescence was otherwise uneventful. She returned to work 6 weeks after the operation and has since remained well.

This case demonstrated the value of a preoperative positive diagnosis by pneumarthrosis, since the pathology could not be discerned on inspection through the line of incision.

Case 3. William F., aged 16 years, student. The patient was well until December, 1925, when while playing basket

ball, he twisted his right knee and fell with the right leg beneath him. He heard something snap in and out. The knee was not swollen and the leg could be straightened, but he walked with a limp for a long time and the knee was sore. In February, 1926, the same thing happened to the left knee, and also in April while pole vaulting. The condition recurred so frequently in both knees that he had no idea how often. He said there was no swelling, and he could straighten the knee after these accidents. The last injury was in the right knee and occurred 1 week ago.

On examination June 30, 1927, the boy walked with a moderate right limp. There was a one quarter inch swelling in the right knee and in the region of the quadriceps bursa. The lateral sulci either side of the patella were partially obliterated. The distention was due to fluid and when the quadriceps bursa was compressed the patella floated. There was no pain on pressure over either cartilage or at any place about the knee. Extension was possible to 165 degrees. Examination of the left knee was negative. Thirty cubic centimeters of a clear straw-colored fluid was removed from the right knee by aspiration. Internal derangement of both knees was apparent. Because of the absence of localizing symptoms, subjective or objective, oxygen injection was done July 2, 1927.

Previous X-ray examination of both knees was negative. There was only slight discomfort when the parts were inflated. After inflation X-ray films showed a prominent left external semilunar cartilage, but all the others appeared negative.

On July 14, 1927, a Krida incision was made exposing the quadriceps bursa of the left knee, which was normal. The patella was dislocated to the outer side thus giving free access to the knee joint. There were many synovial fringes, especially in the anterior part of the joint, which were removed. The infrapatellar fat pad was hypertrophied and had many fringes. The internal cartilage was moderately loose, but otherwise negative and was easily removed. The external compartment was exposed by dividing the infrapatellar fat pad which was removed. Just lateral to the center of the external cartilage on its superior surface was an attached placque of cartilage, crescentric in shape and about three-eighths inch in diameter. Another such placque but much smaller was found near the posterior horn. The cartilage with the attached placques was removed and the wound closed in layers.

A 3 inch vertical incision was made over the outer cartilage of the right knee. The synovia bulged into the wound because of the increased tension of the intra-articular fluid. When the joint was opened, straw-colored fluid gushed forth. There was no evidence of any change within this or any of the joints as a result of the oxygen injection. The external cartilage was loose and a placque of cartilage one inch in length, resembling that in the left knee but much larger, was attached to its superior surface. This placque extended outward from the inner third of the cartilage. The cartilage and placque were removed and the wound was closed in layers. The convalescence was uneventful except for a slight increase of synovial fluid in the left knee for about 4 months. Three weeks after the operation, the patient was horseback riding, motoring, swimming, and roller skating, and a month later he was playing football.

This case demonstrates the unreliability of the patient's observations. He did not know how often the injury occurred or which side of the knee was uncomfortable. He was not cognizant that after injury the knee was swollen or that it could not be fully extended. Physical examination did not aid us in localizing the pathology. It is in cases such as these that pneumarthrosis is of diagnostic value as well as an aid in the minimizing of the trauma of operation. The cartilages appeared normal, even with pneumarthrosis, as the placques were not sufficiently elevated to be recognizable.

CASE 4. Minnie S., aged 12 years. The chief complaint was "a snapping" in the right knee. She was well until 3 years previously when she fell and was carried home. The next day she limped to the Lankaneau Hospital and a posterior splint was applied and worn for 10 days. X-ray films were negative. She had no other treatment. Since the injury, the knee was easily irritated by exercise. The pain was general but worse on the outer side.

On examination, February 14, 1925, the patient walked with a slight right limp and the body listed to the right. Motion was unrestricted, but at 165 degrees of flexion or extension a painless snap was heard, seen and felt, accompanied by a slight outward rotation of the tibia on the femur. It was best palpated at the joint line just anterior to and above the lower insertion of the biceps tendon. There was a one-quarter inch atrophy of the knee and a three-fourths to one inch atrophy of the leg and thigh. The limbs were of equal length.

A provisional diagnosis of snapping right knee due to a dislocating right external semilunar cartilage was made. On February 21, 1925, X-ray films being negative, oxygen injection was suggested. On April 24, 1926, there was no greater discomfort than usual until one week previously. The knee snapped almost continuously when patient walked and also when she moved it in bed. This caused pain on the outer and posterior aspects of the knee. The findings clinically did not differ from the original examination 14 months before.

Pneumarthrosis of the right knee was performed on July 30, 1926. The patient was only slightly uncomfortable when the knee was distended. X-ray examination showed a prominence of the external semilunar cartilage which was displaced slightly externally as seen in Figure 4.

On examination March 12, 1927, the patient had pain in the right knee after exertion for the past several months. A diagnosis of strain secondary to the added trauma, incidental to use, because of the snapping right knee, was made and the knee was strapped.

August 16, 1927, she was again seen. When the patient was active and jumped about, the part snapped and was painful. The patient stated that the right knee was uncomfortable when active and the left when at rest. Neither knee was swollen, and all motions were unrestricted. Examination of the left knee was negative.

Without a definite diagnosis, and because of the age of the patient, operation had been delayed, but in view of recent experiences and the similarity in appearance of this and the other X-rays, a definite pre-operative diagnosis of a dislocating external semilunar cartilage was ventured. This, together with discomfort in left knee, due probably to added strain led to an exploratory operation.

On August 29, 1927, a vertical incision was made and when the synovia was incised and the knee flexed and extended, the cartilage was seen to be very loose and slipped backward into the joint. The cartilage was divided and removed and the wound closed in layers. The postoperative convalescence was uneventful. As was usual in this series active motion was encouraged after the first 24 hours, and the patient was allowed out of bed in 6 days. The convalescence was uneventful.

SUMMARY

A few cases are reported to suggest the wider use of pneumarthrosis as an aid to diagnosis and treatment. The procedure is simple and in these cases shows that a loosened cartilage may be demonstrated and a fractured cartilage at times definitely shown. Pneumarthrosis should not be used indiscriminately, but only in those cases in which a further aid to definite diagnosis is sought.

The greater popularity of pneumarthrosis will tend to make the interpretation of the films more accurate especially as the findings are checked by operation.

It is also believed that after immediate and active treatment following an injury to one of the cartilages of the knee, if pain and swelling persist and there is an inability completely to extend the knee, an operation is indicated to prevent a chronic synovitis and arthritis.

I wish to express my thanks to Dr. Milton Percival of the Methodist Episcopal Hospital who made the X-ray pictures shown in this series.

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A SUGGESTION FOR OPENING THE PARIETAL PERITONEUM IN LAPAROTOMY

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THE plan here suggested for opening the peritoneum has been employed in the clinic for several years. It has proved so generally useful and effective in protecting the bowel from injury that it seems worthy of illustration and description.

The procedure, as is well illustrated in the drawing, may be described as follows: The surgeon and assistant grasp the peritoneum in two pairs of forceps, lift upon the forceps so that the lax peritoneum is pulled into a peak, and, with the blunt handle of the knife, press into close contact the two underlying moist surfaces of the peritoneum. In addition to holding the two surfaces of the peritoneum together, the knife handle, as it is pushed downward presses away any underlying bowel or omentum. It will be realized that in order to make the two peritoneal surfaces adhere as they do by negative pressure, there must be just sufficient upward pull upon the two pairs of forceps in the hands of the surgeon and assistant to create a negative pressure but not sufficient to cause the diverging walls of the peritoneal folds to separate.

It is clear, of course, that this procedure is dependent upon the peritoneum being so lax that it can be drawn up into a fold, and that this technique should not be used if the peritoneum is not lax.

As soon as the two folds of parietal peritoneum have been brought into contact, as shown in the illustration (Fig. 1), an incision may be made in the apex of the fold without danger that a loop of bowel or a section of omentum be included in the fold, since the interposition of either bowel or omentum between the two folds of peritoneum prevents the close adhesion of their two surfaces by negative pressure.

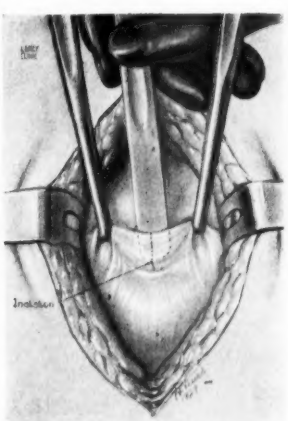

Fig. 1. Showing the method of grasping the lax parietal peritoneum between forceps, the upward traction to create negative pressure, and the knife handle pressing the two moist peritoneal surfaces together where they are held by negative pressure.

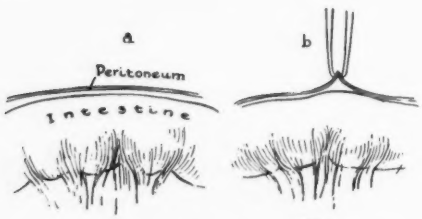

Fig. 2.

Fig. 2. The undisturbed relation of the parietal peritoneum is shown in *a*, the relation of the underlying bowel is shown in *b*, and the two peritoneal surfaces are pulled upward and made to adhere together by the knife handle in *c*.

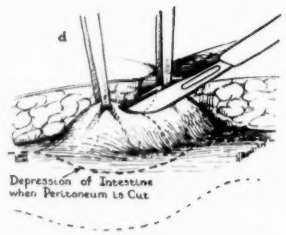

Fig. 3.

Fig. 3. Showing the depression of the abdominal contents away from the cut edges of the parietal peritoneum by the inrush of air as soon as the negative intra-abdominal pressure is broken by the incision of the two adherent folds.

As shown in Figure 2, when the two surfaces are in close apposition, there cannot be bowel between and when bowel is between the folds of peritoneum they cannot be in adherent apposition.

A further desirable feature of this plan is that as soon as the two adherent layers of peritoneum are cut between the two pairs of forceps, the negative pressure within the abdomen is immediately broken up and, with the entrance of air, the underlying bowel and omentum are pushed downward, away from the peritoneum, so that its edges may be grasped with clamps (Fig. 3.).

Every operating surgeon knows how easy it is to include an underlying segment of bowel in the grasp of the forceps which pick up parietal peritoneum. While the plan which has been described greatly diminishes the danger of injury to the underlying bowel, in no way does it eliminate the necessity for caution and care in this step of laparotomy.

PARATHYROID EXTRACT-COLLIP IN ECLAMPSIA AND ALLIED CONDITIONS

Report of Cases

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INSPIRED by the works of J. C. Meakins and William S. McCann concerning the effects of the administration of thyroid extract on patients with nephritis and of the diuretic action thus obtained, I thought that as a logical conclusion it would be worth while to try it in cases of pre-eclamptic toxæmia with marked œdema, high blood pressure and diminished urine with high specific gravity, albumin and hyaline and granular casts.

The results obtained, and the facts that I bring out in the historical notes farther down, have encouraged me to extend the experiment to more advanced cases in which the eclamptic convulsions or coma were present.

HISTORY

The works of Vassale and his followers, Stradivari, Zanfrognini, P. Harvier, and others, have clearly established the effects of gestation and lactation upon the functioning of the parathyroid glands.

The partial destruction of the parathyroids during pregnancy, as well as the fecundation of females who have suffered lesions of the parathyroid—until that time well tolerated—causes the development of grave attacks of tetany, very often fatal. The influence of lactation is similar to that of gestation.

In cases of eclamptic convulsions in which autopsies had been performed, Pepere found, in 3 cases out of 4, lesions or anomalies of the parathyroid glands. Erdheim and Schmorl encountered hæmorrhagic lesions in similar cases; Haberfeld reported atrophy of the glands, and Zanfrognini found only two glands in another case.

ETIOLOGY

It is beyond the scope of this paper to study the etiology and pathogenesis of eclampsia. It will therefore suffice to review the studies made in relation to the blood calcium in eclampsia and the drain made upon the parathyroids by the excessive use of this element during pregnancy.

Morley prophesied that some day the etiology of toxæmias of pregnancy might be explained by some disordered calcium economy on the part of the patient.

Mitchell, in 1910, brought out the theory of calcium deficiency as the cause of eclampsia, and Drennan later on stated that puerperal eclampsia may be caused by a toxæmia the result of a fatty infiltration first and following that, a fatty degeneration of the liver cells, due to the abstraction by the fetus of the calcium.

Morel and Rathery reported a lowering of the antitoxic functions of the liver, following the removal of the parathyroid.

Ahlfield and Schmorl found, in cases of typical eclampsia, pathological conditions which strongly resembled those of acute yellow atrophy of the liver.

Kehrer came to the conclusion that there is a calcium deficiency in eclampsia.

A number of women suffer from a latent insufficiency of the parathyroid glands, which becomes more noticeable during pregnancy. This is especially true of the second half of pregnancy during which a large amount of calcium is taken from the mother for use in the fetal bones. There are also to be noticed the osseous lesions at times present in the mother, such as dental decay, softening of bones, etc. "This condition is often aggravated by toxæmias of a disturbed metabolism, or is due to morbid processes occurring in special organs as in the liver, kidneys, etc." (De Lee).

It has become apparent to me that the differences of appreciation relative to the deficiency or lack of deficiency of calcium in the blood of eclamptic patients (see Table I) is due more to the fact that the amount of calcium present in the blood *cannot* always be used as an index to the functioning of the parathyroid glands. There *is*, evidently, a deficiency in the functioning of the parathyroid glands which may, or may not, be made apparent by the amount of calcium which is present in the blood.

TECHNIQUE

The determination of calcium was done according to the method of Tisdall and Kramer. The serum was separated from the blood and at least 5 cubic centimeters were used. The blood calcium values were determined before the use of the parathyroid extracts and another determination was made 15 hours later.

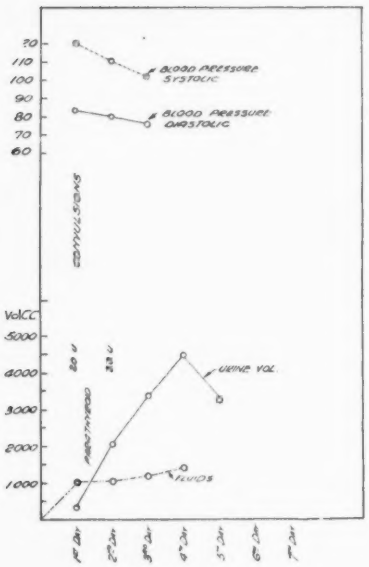

Chart 1. Case 1.

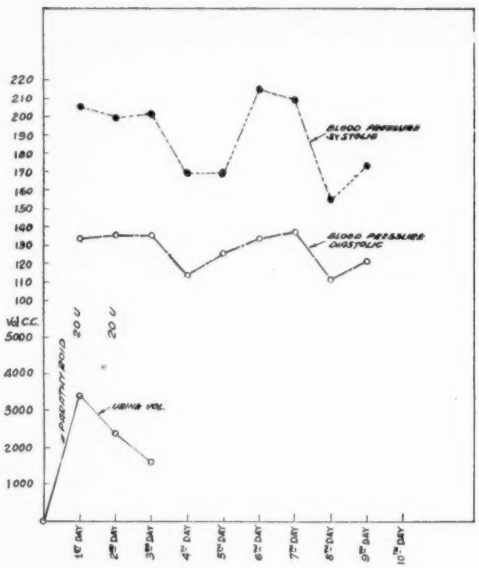

Chart 2. Case 2.

In this report, the calcium figures refer to milligrams of calcium per hundred cubic centimeters of blood serum. The unit dose of parathyroid extract is "One hundredth of the amount of extract which will produce an average increase of 5 milligrams in the blood serum calcium of normal dogs of approximately 20 kilograms weight, over a period of 15 hours." (Collip.)

REPORT OF CASES

Case 1. J. R., a Porto Rican woman, aged 29 years, 5 months pregnant, was admitted to hospital in state of coma, having convulsions every 10 to 15 minutes. The patient had always been in good health; had had typhoid fever in 1912; influenza in 1918. She had been treated occasionally for abscessed teeth. She had been 2 years married, but never pregnant before. From beginning of pregnancy, patient complained of headaches, swelling of ankles and legs, and nocturia. Two weeks before admission she had had a fall.

Physical examination. The patient was a well developed, well nourished woman in coma, with loud stertorous breathing. Convulsions came every 10 to 15 minutes—generalized rhythmic clonic contractions of head, neck and extremities, rolling of the eyes and extreme cyanosis, lips purple, features distorted.

Positive findings were many coarse râles and very harsh breathing, obscuring lung and heart signs. No œdema. Temperature, 105 degrees; pulse, 145; respiration, 68.

Laboratory examination. Blood: negative Wassermann reaction; hæmoglobin, 80 per cent; red blood corpuscles, 4,500,000; white blood count, 9,000; normal differential blood count and normal blood smear; blood calcium on admission 9.4 milligrams per 100 cubic centimeters of blood serum.

The urine when boiled became solid. The sediment contained many hyaline and granular casts. Phenolsulphonephthalein excretion, 10 per cent for 2 hours.

Course under treatment. The course of events is shown graphically in Chart 1. On admission the urine output was very small, a total of 60 cubic centimeters catheterized specimen in 12 hours. The patient could not swallow and fluids were given by rectum.

Twenty units of parathyroid extract-Collip (para-thormone-Lilly) were given at 2 a.m. (12 hours after admission) and ½ grain of morphine every half-hour for 4 doses. Four hours later, convulsions had stopped, the patient was breathing easily, the temperature was 103 degrees, and the pulse was 120.

On February 9, 2 doses of parathyroid extract were given (10 units each). There were no more convulsions. The urine output had increased remarkably and the general condition was fair.

On February 11, the blood calcium was 11.5 milligrams per 100 cubic centimeters blood serum. The blood pressure came down to 102-76. Urine output 3,360 cubic centimeters in 24 hours. (Diuresis continued for 8 days.) Patient began to have pains and after 9 hours of labor was delivered of a macerated fetus.

On March 7, she was discharged in excellent condition; no albumin or casts were present in the urine and the phenolsulphonephthalein excretion was 80 per cent in 2 hours.

Case 2. Mrs. E.M., aged 28 years, was admitted to the Pan American Hospital on November 7, 1928, complaining of dizziness, headache, and failing eyesight approaching blindness. Patient had had a bloody vaginal discharge for several days and was in labor on admission. She gave a history of repeated premature stillbirths following severe œdema, albuminuria, and convulsions.

Examination. Patient was ill at ease in bed, very pale, with generalized œdema involving face and ankles. The

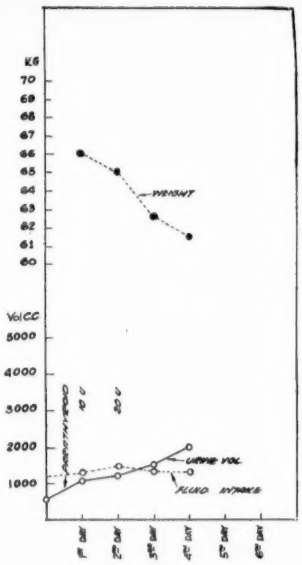

Chart 3. Case 3.

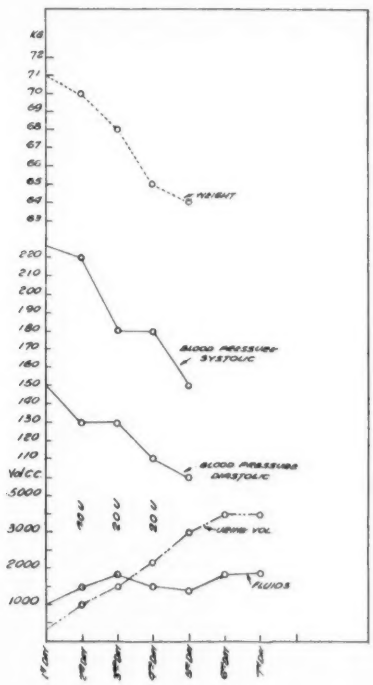

Chart 4. Case 4.

pupils were regular and reacted well to light and accommodation. The patient resisted eye examination so that the retina and the disks were not seen. She was 7½ months pregnant. Blood pressure was 206-136. Temperature 99.4 degrees; pulse, 82; respiration, 20. Fetal heart was strong, 140 per minute. Lungs resonant with normal vesicular breathing, a few crackling râles over both bases.

Laboratory findings. Examination of specimens of urine disclosed reaction, acid; specific gravity, 10.18; very large amount of albumin present, no sugar. Red cells: leucocytes and many hyaline casts were present. The volume of urine in the first 24 hours was very scanty.

Blood examination showed: hæmoglobin, 60 per cent; red blood cells, 3,290,000; white blood cells, 8,000; differential count, normal; smear, normal; Wassermann reaction was negative; blood calcium, 10.2 milligrams per 100 cubic centimeters of blood serum.

Course under treatment. Chart 2 shows graphically the course under treatment. On November 8, 20 units parathyroid extract-Collip were given intermuscularly. Ten hours later, headache and dizziness had disappeared. The eyesight had improved greatly. Patient was then able to read. Blood pressure remained around 200-135. Twenty units parathyroid were given 12 hours later. Blood pressure came down to 170-114. Patient continued having labor pains, but they were very weak and at greater intervals. The urine volume increased to 3,414 cubic centimeters in 24 hours. Blood calcium was 9.9.

On November 10, the blood pressure again went up to 210. Twenty units of parathyroid were repeated. Labor pains ceased. Blood pressure came down and patient started in labor again at midnight, giving birth to a living child at 8 a.m.

The patient was discharged on November 18, the urine still showing a faint trace of albumin, no red cells, leucocytes, or casts. Volume was around 1,500 cubic centimeters in 24 hours. The baby was in good health and progressing normally.

CASE 3. (Treated by courtesy of Dr. J. A. López.) Mrs. G.D., a white woman, married, aged 27, primigravida, was admitted to hospital on October 28, 1928. Family and personal history are irrelevant. Patient had fair general health. She was pregnant 8 months. Generalized œdema involved face, ankles, etc. She suffered severe headache and was dizzy. She weighed 66 kilograms. Blood pressure, 125-80.

Laboratory examinations. Urine: There was almost a complete coagulation of albumin when the urine was boiled. Specific gravity, 1.015. Sugar was not present. There were many hyaline casts and quite numerous granular casts and leucocytes. Blood: Wassermann was negative; hæmoglobin, 70 per cent; red blood corpuscles, 4,335,000; white blood count, 12,000; blood calcium, 9.3 milligrams per 100 cubic centimeters.

Course under treatment. On admission a salt-free diet was prescribed, with 60 grams of protein. The liquid intake was kept at 1,200 cubic centimeters. There was no change in weight from October 28 to November 2, the patient keeping constantly around 66 kilograms. The volume of urine voided remained between 450 and 540 cubic centimeters.

On November 2, at 5 p.m., 10 units of parathyroid extract were given intermuscularly and for 24 hours following the urine output doubled, the œdema began to disappear, and patient lost 1 kilogram of weight. Twenty units of parathyroid were repeated on November 3. The urine volume kept increasing for 8 days to a maximum of 2,500 cubic centimeters and the weight came down to 61 kilograms. Headache and dizziness disappeared. The albu-

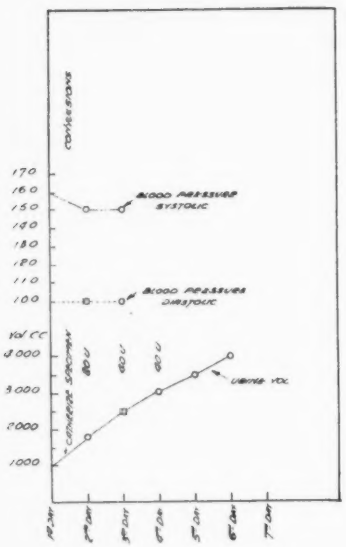

Chart 5. Case 5.

min was diminished to a faint trace and there were no granular or hyaline casts present. On November 14, patient entered, in labor, and was delivered (by Dr. J. A. López) by forceps, of a fetus suffering from asphyxia neonatorum and having left club hand and foot. The child died shortly after. Convalescence of patient was uneventful; she left the hospital in very good condition on November 25.

Case 4. Mrs. S.W., aged 24 years; married; primipara, pregnant 4½ months. Patient had been under my observation from beginning of pregnancy which had been uneventful until 2 weeks before admission to hospital on March 10, 1928, when she suddenly developed extensive œdema with albumin in urine in large amounts and casts. Although patient was kept on a salt-free diet with a very low protein intake, the patient became more œdematous and started to have muscular twitchings, amnesia, extreme nervous excitation, mental unbalance, hemianopsia, and vomiting.

Physical examination. The patient's weight was 71 kilograms. She was of an ashen pale color, apparently very uncomfortable, twitching continually, and very cross and irritable. Both eyes showed evidence of albuminuric retinitis; there were râles over the chest; the cardiac impulse was very diffused and almost inaudible. There was marked œdema of the legs and face. Blood pressure 225-150. Urine volume, 750 cubic centimeters in 24 hours. Phenolsulphonephthalein excretion was 20 per cent in 2 hours.

Laboratory examinations. Wassermann reaction, negative. Red blood cells, 3,920,000; white blood count, 10,400. The urine showed no sugar, large amounts of albumin, casts (granular and hyaline). Blood calcium 9.3 milligrams.

Course under treatment. Chart 4 is a graphic description of the progress made while she was under treatment. Forty units of parathyroid extract were given intermuscularly. The urine volume increased to 1,000 cubic centimeters in the first 24 hours, 1,500 cubic centimeters the second day. Blood pressure dropped to 180 the second day and the patient lost 3 kilograms of body weight. Twenty units of parathyroid repeated the third day; urine volume increased gradually to 3,500 cubic centimeters on the sixth day. The blood pressure came down to 150-100 and weight decreased to 64 kilograms, a total loss of 7 kilograms in 6 days. The general condition of the patient had improved remarkably and she was allowed to get out of bed. Phenolsulphonephthalein excretion, 80 per cent in 2 hours. Blood calcium, 9.7.

The patient was discharged and readmitted a month later, when she was delivered of a dead fetus after a few hours of labor. She showed albumin and hyaline casts for 4½ months and she still has a slight trace of albumin in the urine, but no casts.

Case 5. Mrs. E. R., iii-para, pregnant 8 months, was treated at home. When first seen patient was having convulsions every few minutes, lapsing into coma between convulsions. The history was inadequate; the patient had not been under medical care before.

Physical examination. A white woman, lying motionless in bed, her mouth open and covered with a bloody foam, breathing rapidly and with difficulty, cyanosed (of a blue almost black). Suddenly she began to tremble and the respiration almost stopped, her eyes turned, her face twitched, and she went into a convulsion lasting several minutes. The blood pressure between convulsions was 160-90.

No laboratory examinations were made.

Course under treatment. Eighty units of parathyroid extract were given followed by ½ grain of morphine. The convulsions ceased 4 hours later but the patient stayed in a state of coma until the next day when another dose of 40 units of parathyroid extract was repeated. She slowly came out of coma, however, her mind was blank, showing aberrations and mental unbalance, which persisted for 2 weeks, until after the patient had been delivered normally of a living fetus. Her postpartum recovery was uneventful.

All of these cases were more or less advanced stages of the same condition, "eclampsia parturientum." A few units of parathyroid extract initiated a diuresis usually beginning at the second or third day after injection, which increased daily for 4 or 5 days until the œdema disappeared. In 2 cases there was a decrease of blood pressure amounting to 40 millimeters of mercury.

The subjective signs of dizziness, headaches, disturbances of vision, and muscular cramps disappeared in the same ratio as the œdema.

In the cases of the two patients who had convulsions and other evidences of tetany, the convulsions ceased shortly after the first injection.

In *no* case was labor started by the injections and in one patient who had come in labor, the pains disappeared and did not return while the treatment lasted.

In the patients who came with live fetus, the fetal heart suffered no change and went through in a normal way until labor started.

The calcium in the blood serum did *not* show an appreciable increase after the use of the parathyroid extract.

TABLE I

	Calcium figures for adults and normal pregnancies				Calcium figures for pathological pregnancies		
	Normal blood	Pregnancy 1st half	2nd half	Post partum	Albuminuria	Pre-eclamptic	Eclamptic
Lamers (Serum)	10.81						
Consoli (Blood)	9.0	9.5	9.5				
Underhill and Dimick (Blood)	6.5 (5.8-8.0)	III mos. 7.7 (6.1-9.6) IV mos. 8.6 (7.3-10.1) V mos 7.1 (6.5-7.5)	VI mos. 7.7 (5.5-10.0) VII mos. 7.5 (5.7-6.9) IX mos.8.1(6.6-9.2)	II day 7.4 (5.6-9.6) X to XII day 7.5 (6.1-9.7)			
Jansen (Blood)	8.75-8.9	III mos. 9.8 IV mos. 8.0		8.9			
Salvesen (Blood)	9.5-10.5						
Kehrer (Blood)	7.05-7.53	IX-X mos. 6.59-6.61	IX-X mos. 6.59-6.61	VIII to IX day 6.46-6.64	5.84		
Plass and Bogert (Serum)	9.7-10.6	II mos. 9.9 III mos. 9.1 IV mos. 9.4 V mos. 9.1	VII mos. 8.9 VIII mos. 9.0 IX mos. 9.0	IV to VII day 9.1 XV to XXI day 10.2		8.6	8.4
Stanley Duncan and Sisson	9.9		IX mos. 9.6		10.3	10.2	10.7
Feinberg and Lash		10.94	10.94		9.5	10.21	10.21
Bockelmann and Bock	10	9.61	9.50				8.98
R. E. López (Serum)						9.5	9.5

The dosage of parathyroid extract used was of a tentative nature. The maximum and minimum dosage will evidently be definitely determined by more extensive research.

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THE EXPOSURE AND THE ANATOMICAL RELATIONS OF THE FIRST RIB IN AN EXTRAPLEURAL THORACOPLASTY[1]

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ADEQUATE exposure is a cardinal principle underlying all surgical operations, and the importance of observing this principle increases in proportion to the inaccessibility of the part and its proximity to important structures. The relative difficulty of exposure and the intimate relation of the first rib to important structures lead some surgeons to avoid resecting this rib in performing an extrapleural thoracoplasty; however, experience has shown that the first rib must be partially resected in order to obtain sufficient pulmonary compression. This is due to the fact that the bony chest wall hangs on the first rib, the bucket-handle movement of which allows a surprising amount of additional collapse of the chest following its resection.

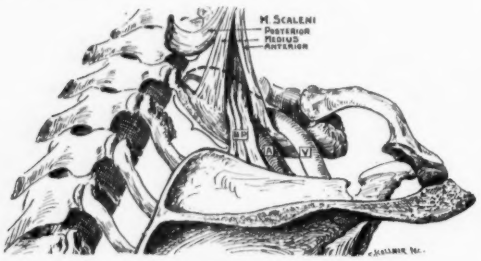

Fig. 1.

Fig. 1. The illustration (a postero-lateral view) shows the anatomical relations of the first rib to certain important structures; *BP*, brachial plexus; *A*, subclavian artery; and *V*, subclavian vein. The dome of the pleura is outlined by the heavy broken line. The supreme intercostal artery is seen above the first rib in the space exposed by the displacement of the scalenus posterior muscle. The bracket indicates the portion of the first rib that is resected in an extrapleural thoracoplasty.

Fig. 2. The illustration shows the exposure of the upper ribs in an extrapleural thoracoplasty. Only two ribs remain to be resected. The fourth rib is intact. The first rib has been transected just lateral to the transverse process (see arrow). The important feature to note is that the alignment of the first rib is perfect. This enables the operator to resect the desired portion of the rib before the adequate exposure has been disturbed by the distortion and displacement that follows when this rib is resected last. After the first rib has been resected the fourth is removed without difficulty.

The insert shows how the alignment of the ribs is disturbed when the first rib is the last one to be resected. The first rib has been transected posteriorly. In practice the displacement, overriding, and consequent interference with the originally adequate exposure is greater than is shown in the diagram.

Although satisfactory exposure of the necessary part of the first rib may be obtained by well placed retraction of the upper angle of the incision, any simple method of improving the exposure should be welcome. The following quotation from Alexander[2] accurately describes the situation: "The first rib is not difficult to identify. Its radius of curvature is very much shorter than that of the second or third ribs. Its flat surfaces face superiorly and inferiorly rather than externally and internally as do those of the other ribs, and its 'lower' edge presents externally rather than inferiorly. No other rib can be felt above it; if a cervical rib is present that fact will have been determined before operation by the roentgen-rays. The firm cords of the brachial plexus can be felt and dimly seen through the

[2]Alexander, John. The Surgery of Pulmonary Tuberculosis, Lea and Febiger, 1925.

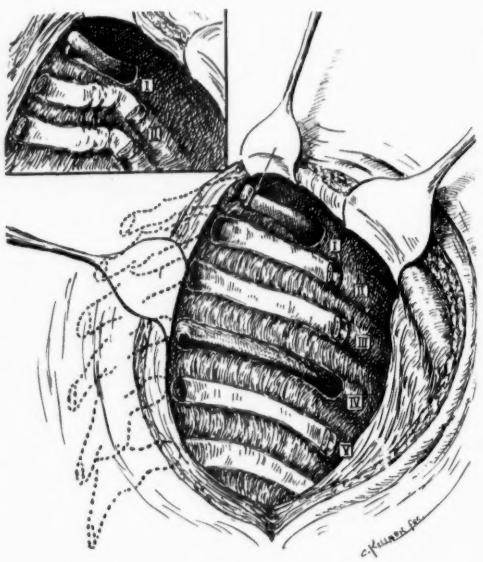

Fig. 2.

[1]From the Department of Surgery, Yale University School of Medicine, New Haven, Connecticut, 1929.

areolar tissue which surrounds them as they pass from the side of the cervical vertebræ toward the axilla. Just in front of the brachial plexus can be felt the pulsations of the subclavian artery as it crosses the rib. The plexus and artery are separated from the subclavian vein by the insertion of the scalenus anticus muscle.

"Stripping the periosteum from the first rib, especially from its internal edge, is tedious work as it must be done with care so as to avoid wounding the plexus and artery, the superior intercostal vessels, and the dome of the pleura. . . . In addition to the periosteum, the scalenus medius insertion and perhaps a slip of origin of the serratus anterior is separated from the rib. No attempt is made to identify the individual muscles. . . . Removal of a greater length rib than 3 centimeters is technically difficult and exposes the subclavian artery to the danger of being wounded by the cut end of the anterior stump; Brunner has reported a fatal case of erosion of this artery by the stump of the first rib." It is probable that there are unreported instances of similar disasters as well as accidental injuries to important adjacent structures which occurred during operative procedures. The tendency toward widespread adoption of surgical collapse therapy in pulmonary tuberculosis may increase the dangers, and any modification by which the operative risks are decreased will be of value. The purpose of this communication is to describe a method for maintaining excellent exposure of the first rib in the operation of extrapleural thoracoplasty.

The first rib should be resected laterally from the tip of the transverse process almost to the groove of the subclavian artery. The anatomical relations of this portion of the rib, as shown in the accompanying diagram (Fig. 1), are more cogent than any additional comment in directing attention toward the possible dangers incident to its resection.

In the complete operation of extrapleural thoracoplasty, the usual procedure is to resect the lower ribs from below upward and then to remove the upper ribs in the following order: fourth, third, second, and first. The disadvantage in this procedure is that after the first rib (the last one to be resected) has been transected posteriorly, there is an immediate collapse, due to the bucket-handle movement of the first rib, with consequent rotation of the ribs downward and backward as a result of which the cut ends of the ribs swing upward. This disturbs the originally adequate exposure of the first rib and makes its second section more difficult (Fig. 2).

This difficulty can be readily avoided if the usual order of resection is altered as follows: If the upper ribs are removed in the order third, second, first, and fourth, the alignment of the first rib is not disturbed (Fig. 2) until after its resection is complete, as the final collapse follows the resection of the fourth rib. Inasmuch as the exposure and resection of the latter rib is quite simple, the removal of the first rib is thereby rendered safer and easier.

The purpose of this report is to simplify the exposure of the first rib and thus reduce the operative danger for that ever increasing group of surgeons who are performing extrapleural thoracoplasties for pulmonary tuberculosis. If by chance other surgeons have already adopted this simple modification of the technique, their claim for priority will be readily acknowledged by the author.

FUNDUSECTOMY

A New Principle in the Treatment of Gastric or Duodenal Ulcer

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SPEAKING generally, one may safely say that (1) the cause of gastric or duodenal ulcer is not known, (2) the treatment is not entirely satisfactory, but (3) such ulcers are rare in the presence of achlorhydria. The last named fact has served as a basis for recent attempts at radical treatment, i.e., subtotal resection.

A. A. Berg, in a very satisfactory schematic outline (Fig. 1), has visualized the generally accepted understanding of the physiological process of acid production in the stomach. He shows four possible methods of stimulating the acid cells to secretion, viz.: (1) afferent impulses; psychic, and through taste and smell; (2) contact of food in stomach; (3) hormones produced in the antrum (not generally accepted); (4) contact of food in jejunum.

The more usual methods of treatment of gastric or duodenal ulcer (duodenal tube, diet, gastro-enterostomy, excision or destruction of the ulcer) and their influence upon acid secretion are diagrammatically depicted in other outline drawings of Berg, which show that a reduction of the acid secretion is but slightly affected, the degree of acidity of the gastric contents depending upon neutralization of the acid after its secretion.

Berg found, after sleeve resection, that the gastric juice is anacid. He states that this is hard to explain, but attributes it to the destruction of an hypothetical center on the lesser curvature which presumably presides over acid secretion.

The experiments of Ivy, Lim, and McCarthy; of Portis and Portis; of Olch; and of others, failed to confirm such an explanation. The more satisfactory results after sleeve resection might be rationally explained by the *removal* of acid secreting cells and the *retention* of the important antro-pyloro-duodenum mechanism which might well be termed the *carbureter* of the gastro-intestinal tract.

The rather unsatisfactory results that followed these methods, other than sleeve resection, prompted Alfred Strauss, Berg, Finsterer, and others to attempt more radical measures such as "longitudinal resection of the lesser curvature" (Fig. 2) and the more generally accepted subtotal gastrectomy (Fig. 3).

(Wm. H. Rodman had previously advocated removal of the "ulcer bearing area.")

Berg found a marked and consistent reduction in acid production after so-called subtotal gastrectomy (75 per cent with no free hydrochloric acid and 10 per cent with low free hydrochloric acid) which was attributed to removal of the second (gastric food contact) and third (antrum hormone) of the four factors regulating the production of hydrochloric acid. The existence of an antrum hormone has not been accepted, and Lim, Ivy, and McCarthy have recently emphasized the importance of the fourth factor (jejunal food contact).

After partial gastrectomy, Klein found immediate anacidity in 78 per cent of gastric ulcers, 18 per cent of duodenal ulcers; after 6 months 100 per cent and 66 per cent respectively, and considered removal of the second, or gastric factor, as the cause.

Lewisohn and Feldman found 77 per cent had postoperative anacidity after gastric resection and that only 3 per cent treated for peptic ulcer by gastro-enterostomy had postoperative anacidity.

A logical explanation of this reduced acidity after partial gastrectomy is that of duodenal neutralization and, what has not been stressed, is the *actual removal* of a variable portion of the acid producing cells of the stomach wall.

But Berg's statement, "The only method of treatment, however, that brings about a permanent and lasting anacidity of gastric contents is subtotal gastrectomy," brings one into controversy, in view of the fact that in from 5 to 10 per cent of gastric and duodenal ulcers the gastric secretion is said to be achlorhydric.

For example: Balfour reports 28 cases of "recurring ulcer following partial gastrectomy." In 55 per cent the hydrochloric acid content was subnormal and in 26 per cent it was absent. He quotes Birgfeld as having collected 53 similar cases. These were probably not all subtotal resection.

Hurst claims that there are in the literature 100 cases of secondary ulcer after gastrectomy which he attributes to a mythical state called a "hypersthenic gastric diathesis."

Lewisohn and Feldman did not find a case of recurrent ulcer with anacidity.

The recurrence of ulcer after partial gastrectomy *with* hydrochloric acid in the gastric contents may be explained by an incomplete or in-

sufficient removal of the acid secreting stomach wall. But such recurrence *without* hydrochloric acid would seem to minimize the importance of hydrochloric acid as a factor in the development of ulcer, and calls for a consideration of post-operative achlorhydria, methods of its determination, and its possible causes.

In order to prove the absence of hydrochloric acid, fractional test meals must be repeated and neutral red or histamine should be used as stimulants.

Achlorhydria may be due to lack of secretion of hydrochloric acid or to its neutralization after secretion; so that, with a gastric content that contains no free hydrochloric acid, the wall of the stomach may, or may not, secrete hydrochloric acid. The bearing of this fact upon the development or non-development of recurrent ulcer opens up interesting possibilities.

With a mucosa that does not secrete hydrochloric acid, ulcer is rare, but recurrent ulcer in 28 cases following partial gastrectomy (Balfour) was associated with hypochlorhydria in 55 per cent and by achlorhydria in 26 per cent.

If hydrochloric acid is present it is reasonable to suppose that too many acid cells were allowed to remain; if hydrochloric acid is absent, granting the accuracy of the observation, all acid secreting cells may have been removed, or cells may remain that continue to secrete hydrochloric acid which is promptly neutralized. The latter may be detected by an estimation of the combined chlorides, or by a much simpler method, the injection of histamine or neutral red.

If the combined chlorides are high, it would suggest that acid had been secreted (possibly exerted an etiological influence) and subsequently been neutralized; or the chlorides, themselves, might have exerted this possible etiological influence upon the gastric or intestinal mucosa.

On the other hand if, in cases of achlorhydria after partial gastrectomy without recurrent ulcer, it was found that the combined chlorides were low, it would indicate that sufficient acid cells had been removed, and emphasize the importance of hydrochloric acid as an etiologic factor in ulcer of the duodenum or stomach and the necessity, in partial gastrectomy, of removing the acid secreting portion of the stomach.

Winkelstein and Marcus claim that neutral red will allow a differentiation between a true achylia and cases in which a small amount of acid is secreted and then neutralized by duodenal regurgitation.

The object of attempts at radical treatment is that of *preventing* the formation of free hydrochloric acid, in contradistinction to the previously mentioned methods that might be called conservative, which aim at *neutralizing* the acid after it is formed; or hurrying it through the stomach by shortening the emptying time.

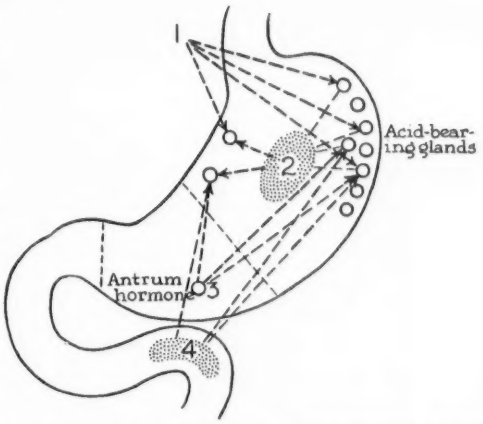

Fig. 1. The usual conception of the mechanism of acid production in the stomach. *1*, Afferent impulses, psychic and through taste and smell; *2*, contact of food in stomach; *3*, hormones produced in the antrum; *4*, contact of food in jejunum (Modified from Berg.)

But the production of a complete, or comparative, anacidity of the stomach contents is a main object in both methods; and subtotal resection seems to accomplish this object in a more satisfactory manner. But it has not met with universal favor and acceptance, because of a high mortality rate (Haberer 8.4 per cent), technical difficulties, and persisting acid in a small percentage of cases.

Therefore it would seem that the present indication in the treatment of gastric and duodenal ulcer is to secure an acid free gastric contents by some procedure less dangerous, with simpler technique and more uniform anacidity.

In reviewing the possibilities one might consider the disease, or sympton complex, "achylia gastrica" which in certain respects fulfills the requirements.

What then are the causes of achylia gastrica?

The exact cause is unknown, but the list of possible etiological factors is long and varied. In 60 cases of true achylia, Winkelstein and Marcus found 10 cases of carcinoma of the stomach, 6 cases of pernicious anæmia, 3 cases of gall-bladder disease, 2 cases of syphilis of the stomach, and 17 cases of subtotal gastrectomy.

A therapeutic attempt to establish in the individual with hyperchlorhydria a moderate degree of pernicious anæmia, hypothyroidism, pulmonary

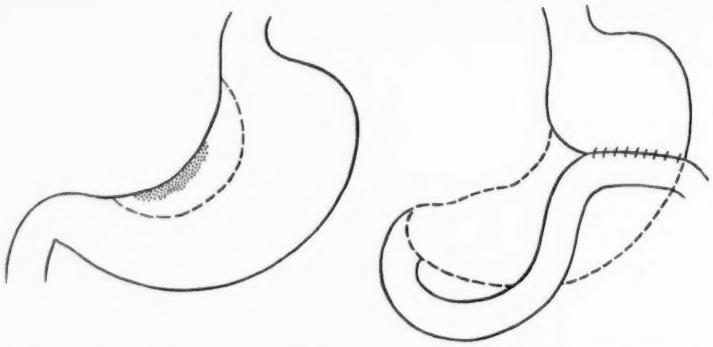

Fig. 2 (left). Longitudinal resection of the lesser curvature. (Modified from Alfred A. Strauss.)

Fig. 3. Effect of subtotal gastrectomy on acid production. (1) not affected; (2) doubtful; (3) entirely removed; (4) not affected. Total result marked 75 per cent of patients. No free hydrochloric acid after operation. Ten per cent of patients free hydrochloric acid below 10. Antrum most important factor in mechanism of acid production. (Berg.)

tuberculosis, or cirrhosis of the liver, sufficient to cause a symptomatic achlorhydria; but not to a degree that will establish the disease, seems fantastic; but the similar use of malaria or rat bite fever in general paresis, or erysipelas in sarcoma shows that such a suggestion is not entirely visionary.

The use of X-ray treatments for the purpose has been suggested by J. Case and Boldyreff and carried out by Gatch, but has not been accepted. Eugene Klein[1] recommends division of the left vagus.

Other than this there seems to be no satisfactory method of producing achylia and I therefore beg to present what seems to be a new principle in the treatment of gastric or duodenal ulcer, i.e., fundusectomy, the *removal, or destruction*, of the acid secreting cells with the *retention* of the important antro-pyloro-duodeno mechanism which controls the transit, the mixing, and the emptying of the gastric contents and regulates the delicate adjustment between stomach and intestinal contents, in contra-distinction to pylorectomy or subtotal resection, which does the reverse, that is, allows many acid secreting cells to remain and removes the normal barrier between stomach and intestinal juices, thus allowing acid-alkali imbalance.

Fig. 4. Schema of alimentary canal and accessory organs.

[1]Ann. Surg., 1929, xc, 65.

A difference in function between the two portions of the stomach, one for secretion, the other for transit, mixing, and regulating outflow and inflow, may be demonstrated in different ways, for example: In the embryological development of the primitive straight alimentary canal one finds various offshoots, diverticula, evaginations or dilatations which by specialization, become various organs; the salivary glands, the liver, the pancreas, the lungs, the thyroid and the thymus (the latter lose their primitive connection with the alimentary canal—(Fig. 4—Huntington).

The fundus of the stomach might readily be looked upon as such a specialized dilatation; an attempt at, or a remnant of, a special structure for the secretion of acid with a broad, wide open communication, rather than the usual narrow gland duct. The site of the lesser curvature undergoes much less apparent change.

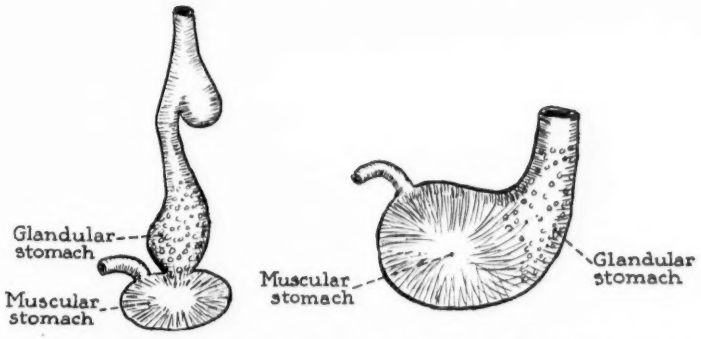

Fig. 5. Schema of stomach of granivorous bird. Stomach of owl. (Huntington.)

In comparative anatomy one finds, in certain lower animals, just such a separate portion of the stomach, more or less sequestered, where the acid glands are accumulated, in the so-called *preventriculus* or glandular stomach (Fig. 5—Huntington). In the kangaroo the lesser curvature is converted into a tube (Horsley). In the human, Bauer (according to Ashoff) has directed attention to this phylogenetic vestige of the duct and gland arrangement, the indefinite boundary between the two being indicated by the course of the oblique muscle fibers which is explained as a dilated sphincter of a one time active check between the acid secreting and the antro-pyloro-duodeno mechanism.

The fundus and the gastric pathway (*Magen Strasse*) are not only in different regions of the stomach, but the gross appearance of their mucosæ is strikingly dissimilar and very suggestive of different functions, as is shown by Figures 6 and 7 (Ashoff).

The *lesser curvature* is short, its blood supply is from recurrent branches of gastric and pyloric arteries; the mucosa is taut and arranged in longitudinal folds like a drainage gutter, suggestive of being used to transfer fluids (Fig. 6). The *fundus* is longer, its blood supply is from the right and left gastro-epigastric arteries and gastric artery; the mucosa is loose, mobile, and arranged in irregular folds like a gland and suggestive of being used for secretion (Fig. 7).

Crohn in a schematic outline (Fig. 8) shows these acid forming cells in the gastric wall to be confined practically to the proximal half of the viscus; part of which is allowed to remain after the usual operation of subtotal gastrectomy.

Y. Miyagawa found the pyloric (non-acid secreting) glands to extend two-fifths of the distance of the lesser curvature from the pylorus to the cardia (Fig. 9). These painstaking observations were made in the human upon two adults and one infant.

The masterly work of Lim, Ivy, and McCarthy and of others has conclusively demonstrated that the acid secreting cells are in the fundic, and not the pyloric, region of the stomach.

It would seem that, in our treatment, we may have been putting the "cart before the horse," in attempting by what might be called remote control to eliminate or influence the stimuli to acid secretion, some of which admittedly cannot be controlled or eliminated by treatment or operation.

Why not stop the secretion of these acid forming cells in the fundus—not by doing something somewhere else, for its reflex action—but by doing something directly to the cells (act as we would if called upon to stop salivary secretion, e.g., remove the gland) by removing the removable portion of the stomach in which the acid secreting cells are situated (the fundus) and, if necessary, destroying the cells in the portion of the wall that must remain for transportation of food.

In the multitude of operative procedures that have been recommended for gastric and duodenal ulcers, I am not familiar with the utilization of this principle, which may be explained by the fact that the original operations were primarily aimed at the relief of the mechanical difficulties, i.e., obstruction; but as these same methods were extended to earlier cases (non-obstructive), in which secretory and not motor phenomena were at fault, the previously successful methods were then often found unsatisfactory.

By removal of the *acid bearing area* (the fundus, which is redundant and therefore easily removable, is secretorily important, but motorily unimportant) instead of the *ulcer bearing area* (the pylorus and antrum which are not redundant and therefore difficult to remove, is secretorily unimportant but motorily important and regulate

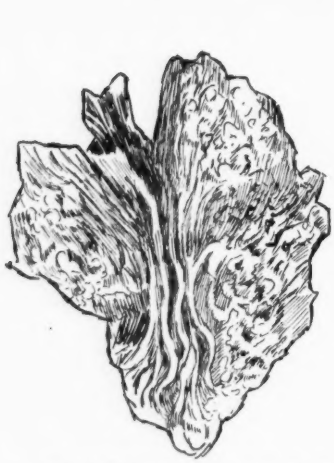

Fig. 6 (left). System of folds in the stomach opened at the greater curvature.
Fig. 7. System of folds in the stomach opened at the lesser curvature.

the delicate pyloric mechanism) it would seem logical to expect a reduction in acidity, with a more physiological gastro-intestinal sphincter and a resultant beneficial influence on those prone to gastric or duodenal ulceration.

In the usual operation the "ulcer bearing area" and the *Magen Strasse* are removed, because they are "vulnerable."

Vulnerable to what? To hydrochloric acid, and an attempt is made to overcome this vulnerability by removing the vulnerable structure and substituting tissue supposedly less vulnerable. We herewith recommend the other horn of the dilemma: viz., to remove the acid secreting cells and allow the motorily important *Magen Strasse* and ulcer bearing area to remain intact. Such an operation is technically easier, the result is more anatomic, and it diminishes acid secretion.

INDICATIONS

In cases in which the disease has progressed to the development of sequelæ such as stenosis, perforation, hæmorrhage, or malignancy, other or additional measures will be required.

The operation of fundusectomy is indicated for the correction of secretory and not motor abnormality, such as persistent hypersecretion without organic stenosis as is often seen in duodenal ulcer or after surgical treatment, in jejunal or gastro-jejunal ulcer, and less frequently in gastric ulcer.

TECHNIQUE

The operative steps need not be discussed here, the question at this time being whether the theoretical claims do, or do not, justify such an operative procedure, the technique of which

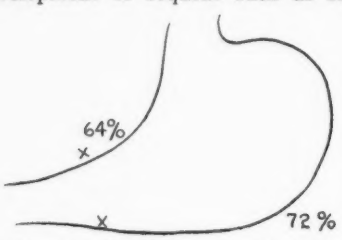

Fig. 8. Showing distribution of acid forming cells. (Crohn.)

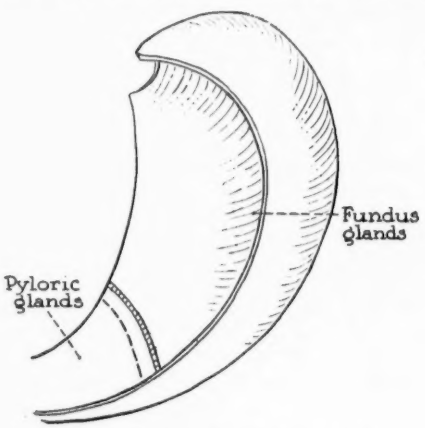

Fig. 9. The human stomach. (Y. Miyagawa.)

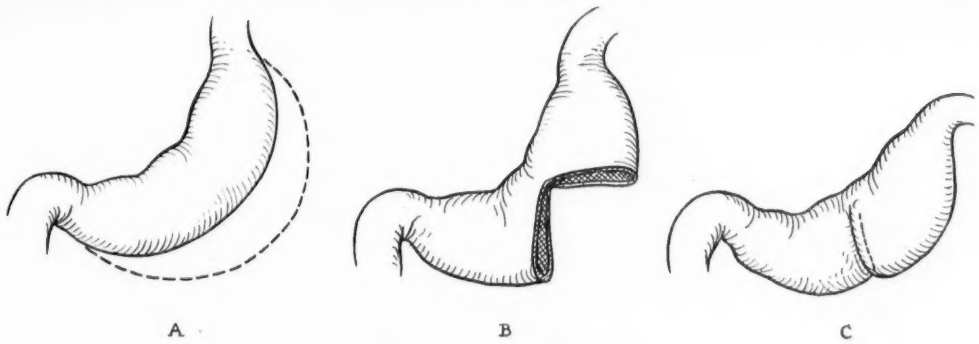

Fig. 10. After fundusectomy.

should present no serious difficulties to one familiar with gastric surgery. It might be performed as a closed operation, a longitudinal resection of the greater curvature (similar to the resection of lesser curvature as recommended by Alfred Strauss in 1924—Fig. 10A), or as a V-shaped or wedge-shaped excision of the greater curvature (Fig. 10B and C).

Fundusectomy may be carried out as a closed operation with clamps, or as an open operation exposing the pyloric and gastric mucosa to inspection or palpation, and if indicated, allowing cautery destruction of remaining acid mucosa.

The danger of peritonitis following such an open exploration will be minimized by the high acidity (a comparative sterility) of the contents.

CONCLUSIONS

1. Results of treatment of gastric or duodenal ulcer are not entirely satisfactory.

2. A more radical method—subtotal gastrectomy—has been recommended.

3. Both conservative and radical methods aim at a reduction of gastric acidity—the former by neutralization, the latter by prevention of acid secretion.

4. Subtotal gastrectomy removes the "ulcer bearing area," the antro-pyloro-duodenal mechanism; and allows part of the "acid bearing area," the fundus, to remain.

5. It is suggested, for cases without stenosis or other sequelæ, that the acid secreting fundus be removed, and the antro-pyloro-duodeno mechanism be allowed to remain.

6. Such an operation should be less dangerous, easier to perform, and the result would be more anatomic with diminished acid secretion.

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COMPLETE LACERATION OF THE PERINEUM

A Report of Two Hundred and Ninety-One Cases Seen Between 1876 and 1928 at The Free Hospital for Women, Brookline, Massachusetts

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THE present article is a single item in a general critical survey that has recently been carried out at the Free Hospital for Women of all the principal operative procedures there employed since the date of the hospital's inception, in 1875. The purpose of this statistical research is to establish a standard of comparison that may prove of use in the future work of this and other clinics. Since studies and reports of cases of complete perineal laceration are meager, this paper was undertaken in order to review the results of a fairly large experience in the treatment of this lesion.

The series of cases of complete perineal laceration herein reviewed was studied from the following aspects: etiology, age, the severity and duration of symptoms, operative procedures, complications, immediate and late results, and results when pregnancy occurred following operation. It is composed of all the cases of third degree tear seen at this clinic[1] over a period of 51 years and of 4 cases in which incompetence of the anal sphincter was not associated with childbirth. One of these four, a single girl of 20, who suffered from urinary and fæcal incontinence, showed no anatomical defect. Although the cause of incontinence was probably neurogenic, operation resulted in a cure. The second, a single girl of 22 years, owed her complete tear to the trauma of falling astride a fence 9 years previously. In the two remaining patients, the loss of sphincter control was the result of postoperative complications. One had been operated upon for hæmorrhoids and fistula-in-ano; the other for an abscess of Bartholin's gland.

In 287 cases, complete laceration had occurred during childbirth. The histories of 19 of these contain no statement concerning delivery. Abnormal delivery was recorded in 234 cases, or 87.3 per cent of the remainder. The types of delivery are recorded in Table I.

The occurrence of toxæmia was recorded twice, of convulsions or eclampsia six times. Only nine patients gave a history of delivery in a hospital.

Of the 34 cases recorded as having had normal labor, eleven had had one or two children; nine had had three or four; and fourteen had had five or more.

[1]This does not include many cases that came to the Out-Patient Department, but failed to report for treatment in the main hospital.

LABOR AT WHICH TEAR OCCURRED

Labor	Number of patients	Percentage
First	185	64.6
Second	41	14.3
Third	24	8.1
Fourth	15	5.2
Fifth	5	1.7
Sixth	6	2.0
Seventh	2	0.69
Eighth	2	0.69
Ninth	1	0.34
Thirteenth	1	0.34
Fourteenth	1	0.34
Unknown	4	1.3

AGES WHEN COMPLETE LACERATION OCCURRED

Age	Number of patients	Percentage
At age of 13	1	0.3
Between 15 and 20	31	10.6
Between 20 and 25	88	30.1
Between 25 and 30	91	31.0
Between 30 and 35	50	17.2
Between 35 and 40	22	7.5
Between 40 and 45	5	1.7
Between 45 and 50	2	0.68
Congenital	1	0.3

SYMPTOMS

In a typical case there is incontinence both of gas and fæces. Frequently, however, patients complain of incontinence of gas only, fæcal incontinence occurring only when the movements are loose. Since constipation is so common among women, complete tears can often be tolerated for years without undue inconvenience. In 22 cases of this series incontinence of gas and fæces was not complained of at all and it was only on examination that the complete tear was found. Undoubtedly, failure to complain of fæcal incontinence was occasionally due to embarrassment. Symptoms such as headache, weakness, backache, pelvic discomfort, and bearing down were sometimes more prominent. Two patients complained of fæcal incontinence only at the time of menstruation. A few patients had no symptoms from the complete laceration until months or even years after the injury. This late occurrence of symptoms was due, probably, to the changes that accompany atrophy of the pelvic tissues. Com-

plete lack of fæcal and gas control was admitted or complained of by 167 patients; partial lack of control was complained of by 102.

DURATION OF SYMPTOMS

	Number of patients	Percentage
Less than one year	52	17.5
One to two years	34	11.7
Two to three years	27	9.3
Three to five years	47	16.2
Five to ten years	65	22.4
Ten to fifteen years	27	9.3
Fifteen to twenty years	10	3.4
Twenty to thirty years	14	4.8
Thirty to forty years	5	1.6
Forty-two years	2	0.68
Not recorded	8	2.7

PREVIOUS OPERATION FOR COMPLETE PERINEAL LACERATION

At the time of first admission to this clinic 78 patients had had previous complete tear operations.

Sixty-two had had one previous repair. Ten of these had been cured or relieved, but had suffered a recurrence as a result of later labors (6 had had one later labor, 3 had had two and 1 had had four later labors). The repair had been unsuccessful in the remaining 52 cases, sepsis being the cause of failure so far as can be determined. Of this group 42 had been repaired immediately after delivery.

Twelve patients had had two previous perineal repairs. One of these, relieved by one operation, had a recurrence with a later labor. None of the other 23 operations had resulted in cure, 16 having been performed immediately following delivery.

Three patients had had three previous repairs. One of these, cured by the first operation, had had a recurrence after three more labors and had received only slight benefit from her second and third operations. All three operations had been unsuccessful in the other two cases.

One patient had had four unsuccessful perineal repairs.

It should be emphasized that only 18 of this group are recorded as having had their repairs performed in a hospital.

EXAMINATION

One hundred and three patients were found to have tears through the sphincter, to or into the anus. In many instances a thin band or scar tissue bridged over the hiatus. Tears running into the rectovaginal septum for from 0.5 to 3, rarely to 4 or 5, centimeters were found in 187 patients. One patient was found to have in addition a complete inversion of the uterus. She had had a forceps delivery 11 weeks before and had entered the hospital because of flowing. Two months after operative restoration of the uterus, complete perineorrhaphy was performed. Two years, four months later she was delivered normally of a full term baby.

TABLE I. TYPES OF DELIVERY

	Number of cases	Percentage
One instrumental delivery	157	67.3
Two instrumental deliveries	43	18.0
Three instrumental deliveries	9	3.8
Four instrumental deliveries	5	2.1
Five instrumental deliveries	3	1.2
Six instrumental deliveries	4	1.7
One breech delivery	9	3.8
Two breech deliveries	1	0.4
Craniotomy (14 and 15 lb. babies)	2	0.8
"Foot presentation"	1	0.4
Total	234	

Twenty-one patients were discharged without operation: 1 was pregnant, 10 refused operation, and 10 were considered unsafe operative risks on account of old age, diabetes, pulmonary tuberculosis, or hypertension.

TREATMENT

Preparation for operation consisted of catharsis (one ounce of castor oil 24 hours before operation), a soapsuds enema, and a boric acid douche 16 hours before operation, and another enema 6 to 8 hours before operation. A light diet with plenty of fluid and carbohydrate was given.

Operation[1]. In 74 cases in which the perineal separation was in the lateral sulci the first part of an Emmet operation was performed, i.e., the lateral sulci were denuded and sutures placed, thus uniting the anterior portion of the levator ani muscles to the sides of the rectum. In 196 cases in which the tear was in the median line and not along the sides of the rectum, either the first part of a Clark operation or a simple median triangular denudation was performed with catgut approximation from side to side, care being taken not to make the introitus too tight. When the tears extended far up the rectovaginal septum, the denudation was begun above the upper angle of the wound and was carried down on either side to the Bartholin ducts, care being taken to remove only a small amount of tissue in the region of the introitus. The tear in the rectum was then closed with interrupted fine catgut sutures down to the anus after which the vaginal mucous membrane was approximated with interrupted catgut sutures to the introitus.

When the internal part of the operation was finished the external part was treated as follows: a

[1]Graves' Gynecology. 4th ed.

rectangular external perineal area with rounded corners was denuded, having as boundaries the two Bartholin ducts and the two dimples formed by the ends of the torn sphincter on either side of the anus. All scar tissue was dissected away. The bellies of the levators and the ends of the torn sphincter were brought into view by tenacula. Figure-of-8 sutures of No. 1 tanned catgut were then placed in both the levator and sphincter muscles, after which interrupted silkworm-gut stitches were placed transversely from introitus to anus so as to include the skin, levators, and sphincter, but not the rectum. The buried figure-of-8 stitches of catgut were tied so as to approximate but not constrict the levators and the ends of the torn sphincter. The silkworm-gut stitches were tied so as to give approximation without tension and were then shotted and cut.

Postoperative treatment consisted in keeping the bowels closed for about 9 days, the diet consisting of fluids and soft solids with a low residue. After the bowels were opened, (castor oil by mouth and cottonseed oil by rectum) the silkworm-gut sutures were removed.

COMPLICATIONS

Slight stitch sepsis occurred in the majority of cases but was of little significance since 89.3 per cent of the patients were discharged from 14 to 24 days after operation with perineums anatomically and functionally normal. One patient died 13 days after operation of mitral heart disease with decompensation (1907). Another patient, perfectly well when discharged 24 days after operation, was readmitted 36 hours later and died of streptococcus septicæmia in 3½ days. The perineum had been severely traumatized by too early and brutal coitus (1905).

Deep stitch abscesses occurred in 10 patients and all healed within 6 months. Eight patients had a temporary rectovaginal fistula (1 to 3 millimeters in diameter) which did not give more than slight annoyance. One fistula cleared up in a year. A rectovaginal fistula large enough to demand operation occurred five times. It was closed successfully in the three patients who underwent operation.

Operation was a failure, due to sepsis, in 5 cases, 3 of which had been treated before 1902. A second operation was performed in two of these, with relief in one and cure in the other.

At the time of discharge from the hospital 4 patients were only relieved, i.e., there was some healing, but the anatomical and functional result was imperfect. A second operation cured 2 of these cases.

One patient, cured at the time of discharge, had an ischiorectal abscess when examined 2 years, 3 months later. Two patients, well after operation, had a fistula-in-ano 2 years and 5 months, and 2 years and 10 months later, respectively.

RESULTS

In the consideration of a lesion of this sort it has been found that a good functional result indicates a good anatomical result. By "failure" is meant that the local condition was at least no better than when first seen. "Relieved" indicates an improvement. This covers the patients who had stitch abscess, rectovaginal fistula, fistula-in-ano or improved but not perfect function. By "cure" is meant a satisfactory anatomical and functional result.

Result at time of discharge from hospital: Failure, 5, or 1.8 per cent; relieved, 24, or 8.9 per cent; cured, 240, or 89.3 per cent.

Result three years after operation (patients who became pregnant are not included). Traceable, 81: Failure, 1, or 1.2 per cent; relieved, 12, or 14.8 per cent; cured, 68, or 83.9 per cent.

Result 5 to 25 years after operation (patients who became pregnant are not included). Traceable, 56: Failure, 1, or 1.7 per cent; relieved, 8, or 14.2 per cent; cured, 47, or 83.9 per cent. Seven of the traceable cases died: (1) 1 year, 5 months, of intestinal obstruction; (2) 1 year, 9 months, of lobar pneumonia; (3) 6 years, 5 months, of pelvic carcinomatosis; (4) 8 years, 4 months, of heart disease; (5) 10 years, 8 months, of appendicitis; (6) 17 years, of pulmonary tuberculosis; and (7) 25 years, of acute nephritis.

PREGNANCY AFTER OPERATION

Thirty-eight patients are known to have become pregnant after operation. Three were pregnant when seen 4 months to 2 years and 7 months after treatment and have been untraceable since. One to three miscarriages occurred in 5 patients, 4 of whom were well when traced 3 to 10 years after operation. The other was relieved one year later. Seven patients had one cæsarean delivery; one had two cæsarean deliveries; and one had four. Six of these were cured 1 to 11 years after repair at this clinic; three were relieved 1, 12, and 16 years later respectively.

One patient died 8 years, 8 months later (cause unknown), having had three more labors about which no information could be obtained. A second patient died of bronchopneumonia following labor during the 1918 influenza epidemic.

The 19 remaining patients had in all 30 children (20 were delivered normally and 10 with forceps)

and seven miscarriages. Normal deliveries resulted in recurrent complete tears in 6 cases, 3 of which were cured by further operation. A seventh patient had a recurrent tear following an instrumental delivery. Twelve patients, 4 of whom had had one or two instrumental deliveries, remained cured 2 to 19 years after their repair at this clinic.

SUMMARY AND CONCLUSIONS

1. A study has been made of 291 cases of third degree or complete tear of the perineum.

2. A history of abnormal delivery was given by 87.3 per cent of patients. Six patients stated that they had had convulsions with the pregnancy that resulted in a third degree tear.

3. Despite the high percentage of abnormal delivery and the comparative frequency of eclampsia, only 9 cases in the series are recorded as having been delivered in a hospital.

4. At the time of complete laceration, 64.6 per cent of the cases were primiparæ.

5. Seventy-three per cent of the patients were under 30 years of age, and 41.3 per cent were under 25, when the complete tear was incurred.

6. The class of patient treated at this clinic may not be unduly inconvenienced by the loss of anal sphincter control. This is indicated by the fact that 22 patients did not complain of fæcal incontinence at all, that a number complained only of occasional inconvenience, and that 60 per cent, at the time of admission, had had symptoms for 3 years or more up to 42 years.

7. Seventy-eight patients, 27.1 per cent of the series, had had in all 99 operations for third degree laceration before admission to this clinic. Twelve patients who had been cured or relieved had been torn again, at a later labor. The remaining 87 previous repairs had been unsuccessful. Fifty-eight of these are recorded as having been performed immediately after delivery. Since then only 18.1 per cent of the repairs in this group were done under hospital conditions, it seems logical that the high percentage of failures was due to performing postpartum operations in patients' homes where it is almost impossible to maintain asepsis.

8. In those cases in which later pregnancy did not occur the results after operation at this clinic from the time of discharge to 25 years later were as follows: failures, 1 to 2 per cent; relieved, 8 to 14 per cent; cured, 83 to 89 per cent.

9. In those cases in which later pregnancy occurred the results were: recurrent tear, 21.2 per cent; partial recurrence, 12.1 per cent; remained cured, 66.6 per cent.

Note: to date there has been no decrease in the number of complete tear cases which have been seen yearly at this clinic.

THE OBER OPERATION FOR CONGENITAL CLUB-FOOT

End-Results in Fifteen Cases

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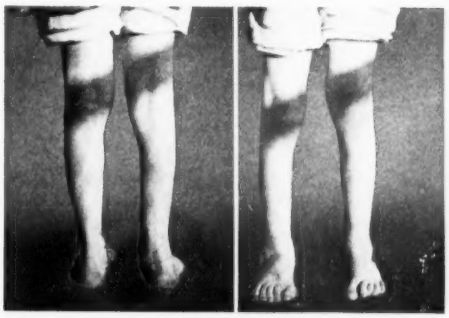
THE object of this paper is to report the results obtained by means of the Ober operation in the treatment of neglected or relapsed cases of congenital club-foot. Fifteen operations were done on twelve patients. I shall also discuss the indications for this operation and its advantages over the more generally used cuneiform osteotomy.

The conservative or manipulative treatment, with possibly a local tenotomy in very resistant cases, has proved most satisfactory in the treatment of the early case. However, it is not in the scope of this paper to discuss the treatment of congenital club-foot in infants or very young children. Forcible manipulations followed by dressings to retain the improvement obtained by the manipulation is a step of great importance, regardless of the age of the patient or the severity of the deformity. At the outset it must be understood that a maximum degree of correction should be obtained by manipulation before there is resort to operation. The deformity involves the whole tarsus and is not the result of any local contracture. It is apparent, therefore, that at least some correction, if not complete, can be obtained by no means other than forcible manipulations. It is impossible by any open surgical operation to divide contractures of all the numerous ligaments and joint capsules present in all the tarsal and ankle joints.

We may dismiss the consideration of the treatment of club-foot in infancy by the statement that open operation, other than a local tenotomy, is never necessary or advisable. In the more severe cases in older children, or in case of relapse not yielding to manipulative treatment alone, open operation must be resorted to in order to obtain a complete correction of the deformity. It is also the writer's belief that, while the time factor is not so important in a child, the duration under treatment is of great importance in the average case. Co-operation of the parents is essential for successful treatment, and if the duration of time the child is under treatment is prolonged, parents are often discouraged and impatient. As a result this reacts on the surgeon who may discontinue retentive dressings before the maximum degree of overcorrection has been obtained or who may not hold the overcorrection sufficiently long to prevent a relapse. After the manipulative treatment has succeeded in overcoming the contractures in all except those persisting in a few well localized structures easily accessible to open operation, a division of these structures through a skin incision is not only more complete, but also causes less trauma to the soft parts and epiphyseal centers than do persisting attempts at tearing by brute force. A clean division of a ligament or joint capsule will result in less fibrosis and less subsequent contracture of the scar, and consequently less likelihood of relapse. In late years the injurious effect of trauma on epiphyses has repeatedly been brought to our attention, especially trauma to the head of the femur occurring during reduction of congenital dislocation of the hip resulting in later deformity of the head of the femur. The condition known as Legg's or Perthes' disease appears to be the result of trauma. It is conceivable, similarly, that deformities of the tarsal bones may result from persisting forcible manipulations. It appears to the writer that perhaps we have been too conservative in continuing manipulation after manipulation when an equally good result could be obtained by more gentle means, and in a shorter period of time. On the other hand, one can not be certain as to what harmful effect a simple procedure as tenotomy of the Achilles tendon may have in later life. It would be interesting to compare, in a series of cases in later life, the effect on the Achilles group of muscles in cases in which tenotomy had been done with a series in which tenotomy had not been done. Similarly, it would be interesting to investigate any deformity of the tarsal bones attributable to trauma.

Before proceeding to the rationale of any operative treatment, a clear understanding of the pathological anatomy is essential. The deformity consists of inversion of the whole foot, abduction of the forefoot, and plantar flexion. In the newborn infant the bone changes are not present, but soon occur with growth in accordance with Wolff's law. Before bony deformity has occurred the chief structures holding the foot in inversion are the contracted internal lateral (deltoid) ligament, the inferior calcaneoscaphoid ligament, the plantar fascia, and the Achilles tendon. The Achilles tendon not only resists dorsiflexion of the foot, but in club-foot also acts as an invertor as it is found deflected toward the media side. Of lesser im-

Figs. 1 and 2. A severe valgus deformity resulting from too much overcorrection. Photographs were made 1 year after the Ober operation. This deformity was subsequently corrected by a subastragaloid arthrodesis.



Figs. 3 and 4. Photographs 2 months after the Ober operation. In this case there was again a little too much overcorrection. The foot was manipulated under a general anæsthetic and put up in plaster in the corrected position.

portance are shortened tibialis posticus and flexor longus digitorum tendons. These structures together with a contracted abductor hallucis muscle resist abduction of the forefoot. The contracted Achilles tendon is the chief obstacle to dorsiflexion. In the severe equinus deformity the contracted posterior portion of the capsule of the ankle joint resists dorsiflexion even after the Achilles tendon has been lengthened.

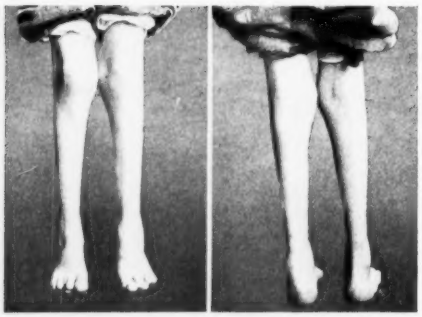
It is therefore apparent that in the operative correction of club-foot attention must be directed toward the deltoid ligament, the inferior calcaneoscaphoid ligament, and the Achilles tendon. If division of these structures fails to secure an overcorrection, further lengthening of the tibialis posticus and the flexor longus digitorum tendons, and a division of the abductor hallucis muscle, must be done. If overcorrection of the equinus deformity can not be obtained following a lengthening of the Achilles tendon, it will be necessary to do a capsulotomy through the posterior portion of the capsule of the ankle joint.

A general principle in all bone operations is to avoid injury to epiphyses in children. The late gross deformities following resection of tuberculous knees in children need only be mentioned to illustrate the calamity of inhibiting or distorting growth of the epiphyses at the knee. This disturbance in growth of the tarsal bones is alone sufficient to condemn a wedge resection in young children. Except in an adult, or in older children who have practically attained the maximum growth of the foot, this operation should not be considered, certainly not before a preliminary Ober operation. In those severe neglected or relapsed cases in which it is apparently evident that bony deformity itself prevents correction, a preliminary operation directed toward the soft parts is advisable. This procedure alone will often suffice in the borderline case. Again, by first obtaining a maximum correction by relieving contracted soft parts the extent of bone interference will be at a minimum. In children, if a bone operation is necessary after a relief of contractures of the soft parts has been obtained, it is quite likely that a procedure along the lines of arthrodeses with the immediate corrective molding of the foot will be sufficient. The immediate postoperative result following a wedge resection is excellent. As growth continues, however, shortening of the foot becomes more pronounced. The writer has seen cases in which the varus deformity has made an about face into a rigid foot in a valgus deformity. A wedge resection does not correct a varus deformity of the os calcis which is essential to a permanently satisfactory result.

A procedure found by the writer to be satisfactory in the correction of club-foot following the previous maximum correction by manipulations is that along the lines of the Ober operation which aims to attain overcorrection by division of the contracted soft parts. That complete overcorrection can be obtained is shown in Figures 1 and 2, that of a case in which too much overcorrection was obtained. It has never been my experience, and in discussing the subject with others I have learned that it has never been their experience, to obtain too much overcorrection. I therefore wish to call particular attention to this case. A note of warning is sounded, therefore, that the plaster dressing following the operation should not hold the foot in the maximum degree of overcorrection possible to be obtained.

THE OPERATION

The writer has made no attempt in the later cases to adhere strictly to the technique described



Figs. 5 and 6. Postoperative result 4 years after bilateral Ober operations. The result is considered unsatisfactory as there still remains a slight varus of the heels. It can not be regarded as a failure.

by Ober. I have proceeded along the line that every ligamentous structure resisting overcorrection is divided, and resisting tendons are either lengthened or divided. A J-shaped incision beginning posterior to the internal malleolus is made extending downward and curving anteriorly below the scaphoid bone. The flap formed is then reflected upward and anteriorly giving an exposure to the deltoid ligament and the calcaneoscaphoid ligament. The former is then completely severed from its attachment to the internal malleolus, and detached subperiosteally from the astragalus to the os calcis and scaphoid. Injury to the vessels and nerve is easily avoided. As a rule, immediately after this procedure, the varus of the heel can be corrected. The thickened astragaloscaphoid capsule and the inferior calcaneoscaphoid ligament are now divided. As a rule this will permit eversion of the foot. The tibialis posticus tendon is generally seen to resist eversion, and, if so, is tenotomized or lengthened. If abduction of the forefoot continues to be resisted, the abductor hallucis is cut through near its attachment to the os calcis. The foot is now forcibly manipulated to a maximum degree, often accomplishing a tearing of a few remaining shortened structures. Finally, the Achilles tendon is exposed by the retraction of the tissues posteriorly and is lengthened. In case there is no great deformity of bone, the foot can now be put into a completely overcorrected position. Occasionally there is difficulty in closing the incision without considerable tenseness of the skin at the line of suture. As a rule mobilization of the skin by prolongation of the vertical limb of the incision upward and undermining will prevent this.

It is well to heed the warning of Ober that the foot not be put up in the maximum obtainable correction in the first plaster dressing because of circulatory disturbance resulting from stretching of the internal plantar artery. A few days later overcorrection can be obtained.

ANALYSIS OF RESULTS

It would be of no interest to report individually on each of the 15 operations. The ages at the time of operation varied from 23 months in the youngest child to 9 years in the oldest. All cases, except one, were relapsed cases of club foot, or those in which persistent manipulations alone failed to obtain a cure. Two cases had had open operative treatment before, 10 cases had had subcutaneous tenotomy of the Achilles tendon, 3 cases had had plantar fasciotomy, and 1 case had had a wedge resection of the tarsus. At the time of the Ober operation the tibialis posticus tendon was lengthened and sutured in 3 cases, and completely tenotomized without suture in 9 cases. The flexor longus digitorum tendon was lengthened in 1 case, and tenotomized in 7 cases. The Achilles tendon was lengthened in 9 cases at the time of the original operation. Posterior capsulotomy of the ankle joint was necessary in 2 cases. The writer has not considered it necessary to delay lengthening of the Achilles tendon in these cases to a second stage operation, because in all there had been previously a maximum degree of correction obtained by manipulative means. It was necessary to divide the abductor hallucis muscle in 4 cases to overcome varus of the forefoot. It apparently made little difference whether or not the ends of the lengthened tendons of the tibialis posticus or flexor longus digitorum were approximated by suture. A considerable degree of limitation of active and passive inversion of the foot remained in all cases. Active flexion of the toes returned in all cases. Apparently, in those in which the tenotomized ends were left separated, adherence of the subsequent cicatrix to the tendon ends was sufficient to bind these tendons firmly. In one case in which too much overcorrection was obtained there resulted a contracture of the long extensor tendons of the toes. At operation, 2 years later, to correct the valgus deformity, it was necessary to lengthen these tendons. In another case (Figs. 3 and 4), a similar but moderate contracture resisting physiotherapy persisted 2 months after the cast was removed. This was easily corrected by forcible manipulation and the application of a cast, under anæsthesia. The Achilles tendon united firmly in all cases.

If the varus of the heel was corrected, and the patient was able voluntarily to overcorrect the deformity, the result was considered excellent; if the

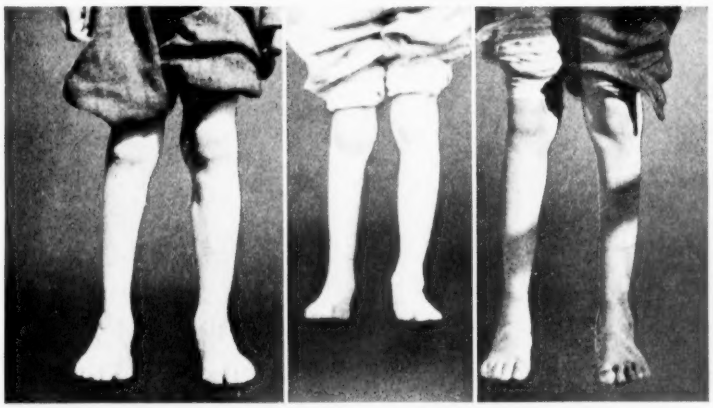


Fig. 7. Fig. 8. Fig. 9.

Figs. 7, 8, and 9. Examples of what the writer considers excellent results. A slight overcorrection has been obtained.

varus of the heel was corrected and the patient stood with no varus or metatarsus varus, even though a definite active overcorrection were not possible, the result was considered good. A completely normal dorsiflexion of the foot was not considered essential. Any remaining, even though slight, varus of the heel or metatarsus varus was not considered a satisfactory result in spite of the fact that slight deformities of this nature caused no appreciable disturbance in function. A result was considered a failure when complete correction was not obtained. It would be desirable, of course, to obtain completely normal flexibility of the foot, but in all cases there remained at least some limitation toward inversion. The writer believes that unsatisfactory results can not be attributed to the principles of the operation, but are due to imperfect technique. Needless to say that in cases with gross deformity of bone the operation on soft parts alone will not be sufficient.

End-results following 15 operations reveal the following: in 6 cases the result was excellent, good in 6, unsatisfactory in 2, and unknown in 1. Included in the unsatisfactory cases is the one of the severe valgus deformity. Certain borderline results are difficult to classify according to any standard. There have been no results which were regarded as failures. Figures 5 and 6 show the result in a child in this borderline group; while complete correction has not been obtained, he walks with no appreciable limp or disability. In no case, except the one with the resulting valgus deformity, has the result been sufficiently bad to require further operative treatment.

CONCLUSIONS

The Ober operation has proved to be a very satisfactory procedure for the correction of congenital club-foot not amenable to manipulations and retentive dressings.

In resistant cases this operation can be done early without fear of subsequent disturbance in growth and the period of active treatment can be materially shortened.

EMBRYONAL ADENOMYOSARCOMA OF THE KIDNEY IN AN ADULT

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EMBRYONAL adenomyosarcoma of the kidney, though relatively uncommon, is well known and thoroughly discussed in the literature. The appearance of this tumor in adult life, however, is decidedly rare and it is on this account that we feel justified in reporting a case that occurred in a man of 48 years.

Embryonal adenomyosarcoma accounts for a large percentage of the malignancy in children, and the majority of the reported cases have been in infants. It has been found in the fetus, and its large size has been reported as a cause of dystocia. Ewing states that it is rare after the tenth year and usually found in the first 3 years. In a review of some 85,000 admissions to the Children's Hospital, Edinburgh, Fraser found several cases but none older than 6½ years. Kelly and Burnam found only two unquestionable cases in adults, and Garceau found four. Other authors have likewise agreed that it is predominantly a disease of early childhood.

Between the years 1915 and 1928 there have been three such tumors in children at the Roosevelt Hospital. Their age varied from 6 months to 4 years. Nephrectomy was done in each case. One child died of recurrence in less than 6 months. The two others were living and well without evidence of recurrence 4 years after operation. Clinically and histologically the cases were typical of embryonal adenomyosarcoma of the kidney.

The usual clinical history is that of a rapidly-growing tumor of the upper abdomen in an otherwise healthy individual. Pain may be a prominent symptom and is located in the flank, radiates to the groin, and is constant in character. Colic-like pain is present when blood clots are passed through the ureter. Hæmaturia is a less common symptom although it may be the first thing noticed by the patient. Digestive disturbances may be present. Loss of weight and strength, though not prominent in the early stages of the disease, combine with the great abdominal tumor to dominate the picture in the latter part of the course. Without treatment the disease is rapidly fatal, but nephrectomy, if done early, will save some cases.

Urine analysis is negative unless there is hæmaturia. The pyelogram gives a shadow that is displaced by the tumor but not otherwise altered in character until rather late, when the tumor invades the kidney pelvis. Blood count shows the changes of anæmia.

Histologically these tumors are classified as embryonal mixed tumors. Prior to the work of Birch-Hirschfeld they had been considered as carcinomata but he definitely placed them in their present category. Subsequently, the epochal study of Wilms further refined this classification. Indeed, the name of Wilms is so closely associated with this neoplasm that it often goes by the terminology of Wilms' tumor. It is also known as embryonal adenosarcoma, embryonal sarcoma, and embryonal adenomyosarcoma. The latter seems to be the most descriptive and is the name by which it is generally known at present.

Opinions as to its histogenesis have passed through various phases. Birch-Hirschfeld considered the wolffian body as its probable origin. Wilms puts it at a later period, but still very early as it must involve ectoderm and mesoderm, and include nephrotome, sclerotome, and myotome. Muus considers that it arises from the renal blastema at an even later period and attributes the multiplicity of tissues to metaplasia. Ewing is inclined to agree with Muus as this concept affords the best explanation of the different forms assumed by the tumor.

Grossly these tumors are the largest of the renal neoplasms at any given time. They lie within the distended renal capsule and are usually sharply demarcated from the normal kidney tissue, which is so pushed to the periphery that it forms a shell for the tumor. The growth is often solid, opaque, and trabeculated, although the larger tumors may be cystic or present hæmorrhage and necrosis in their centers.

Microscopically the embryonal nature of the tumor cells is the most striking feature. The tumor is a true mixed tumor which always contains epithelial and connective tissue elements and usually smooth muscle in addition. Striated muscle, cartilage, and bone have been reported. A variety of epithelial types and arrangements may be encountered but the usual appearance is that of cylindrical or cuboidal cells grouped around a lumen so as to suggest an abortive renal tubule. These structures are supported by spindle cells in strands or broad sheets, among which may be found collections of smooth muscle

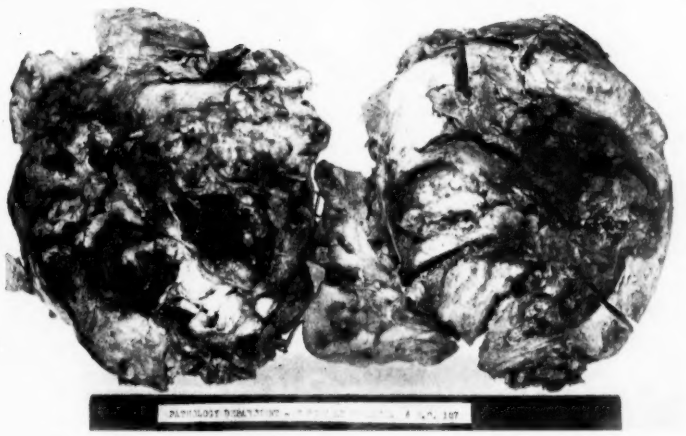

Fig. 1. Photograph of specimen. Embryonal adenomyosarcoma of kidney.

cells. Different parts of the same tumor will show a varying preponderance of one type of tissue over the others. Thus in some areas the appearance is that of an embryonal sarcoma with no epithelium present, and elsewhere the tubular arrangement of the epithelium may be so striking as to cause confusion with the carcinomata.

Metastases and extension are not the rule but do occur in a fair percentage of the cases. Metastases may be of the carcinomatous or sarcomatous elements but, according to Fraser, extension is always of the sacomatous elements. He contends that the earliest form of the tumor is preponderantly carcinomatous and that metaplasia occurs with age giving rise to the sarcomatous characteristics. Hence metastasis may be of either type depending upon the nature of the tumor at the time it invades the blood stream or lymphatics, but extension and infiltration, being necessarily from the older parts of the tumor, must be sarcomatous. The studies of our case do not entirely corroborate this idea. The recurrence was entirely devoid of epithelial elements as far as we could determine, but some of the sections taken from the extreme periphery of the primary tumor showed a great preponderance of epithelium, which should not be present in this location if the theory is correct.

Although predominantly a tumor of infancy, a few cases of adenomyosarcoma of the kidney have been reported in adults. A careful search of the literature reveals 15 of these which are shown in Table I. Some of them, perhaps, may not have been embryonal adenomyosarcoma. Taddei thinks that Jenckel's tumor was benign. MacDonald's case had a long ante-operative clinical course which is not typical of the rapidly-growing embryonal adenomyosarcomata, but the histological structure would seem to place it in this class. Davis classifies the tumor in his case as adenomyosarcoma but the only epithelium he describes was cornified epithelium lining a large cyst. Ewing describes similar epithelium in other embryonal adenomyosarcomata and as the other elements were typical we have classified it in this group. In all the others the descriptions were of tumors that seemed to have the characteristics of embryonal adenomyosarcoma.

Our own case which is reported here makes the sixteenth on record and was in a male of 48. These cases are too few for any accurate deductions to be drawn but there are two interesting features. The first is that the cases are equally divided between the sexes, there being eight of

Author	Age	Sex
Hyman	22	Female
Muus	34	Female
Kocher and Langhans	35	Female
Albarran and Imbert	37	Male
Nicholson	40	Female
Jenckel	43	Female
Keefe and Palmer	44	Female
Hasner	45	Male
MacDonald	50	Male
Rohde	52	Male
Hedren	54	Male
Maas	55	Female
Baumann	59	Male
Thatcher and Fulmer	59	Female
Davis	59	Male

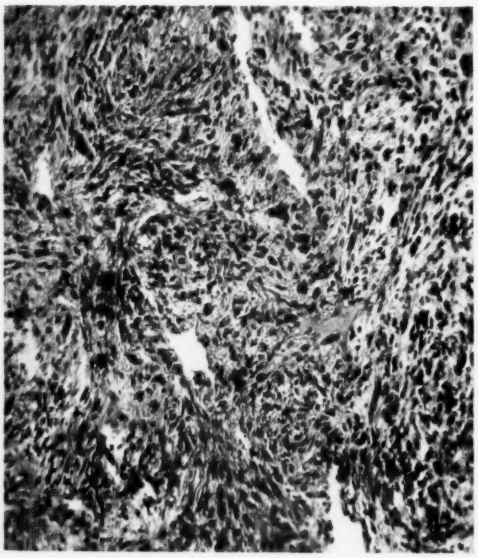

Fig. 2. Sarcomatous area.

each. The second is that 12, or 75 per cent, occurred in the fifth and sixth decades of life, the recognized cancer age.

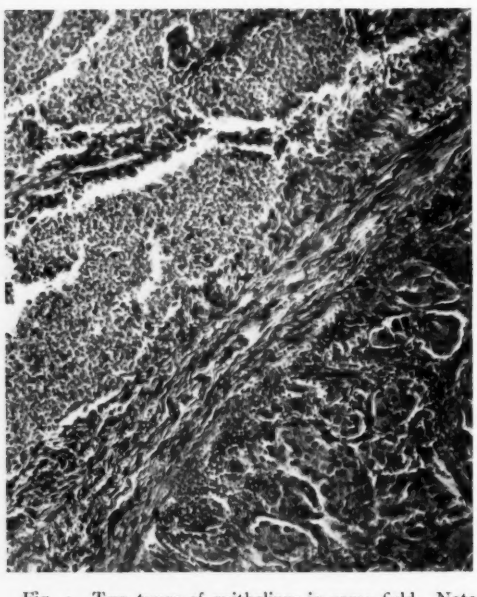

Fig. 4. Two types of epithelium in same field. Note tubules.

Fig. 3. Malignant epithelium in a malignant connective tissue stroma.

REPORT OF CASE

O. K., a white male of American birth, 48 years of age, employed as a factory foreman, was referred by Dr. Thomas Gallon on April 9, 1928. He gave a history of pain in the left flank of about 7 weeks' duration and of hæmaturia of 3 weeks' duration. The pain was rather constant in type, non-radiating, and was associated with a feeling of abdominal distention. He had previously consulted another physician who made a diagnosis of digestive disturbance, although the ingestion of food had never seemed to have any bearing on the pain. The treatment prescribed had no influence on the symptoms. He remained at his work, which, while not particularly hard, entailed standing most of the day. Meanwhile he noticed a sense of weakness in the back on the left side and felt the pain nearly all the time. He states, however, that it was never severe enough to cause him any great concern. During this time his general health remained good although there may have been some loss of weight. Four weeks after the onset of the pain hæmaturia was noticed one morning at the first voiding and this continued at intervals alternating with clear urine. The blood was noted principally in the morning specimens. On a few occasions small blood clots were passed without pain, and except for slight and occasional dysuria and increased frequency of urination no other urinary symptoms were noticed.

His past history was essentially negative. He had suffered no previous major illness and he had always enjoyed good health, except for a tendency to catch cold frequently. These colds had always been easily cured. His family history contains nothing relevant to the present condition.

Physical examination disclosed a well nourished and developed adult white male, who looks quite pale. Eyes, ears, nose, and throat are negative. Chest has equal and

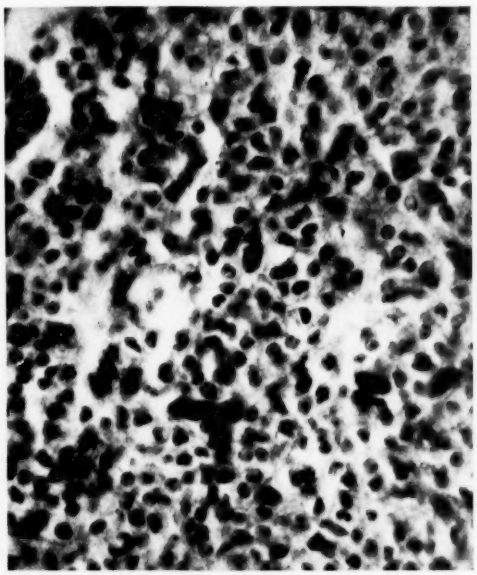

Fig. 5. High power of Figure 4, smaller epithelium.

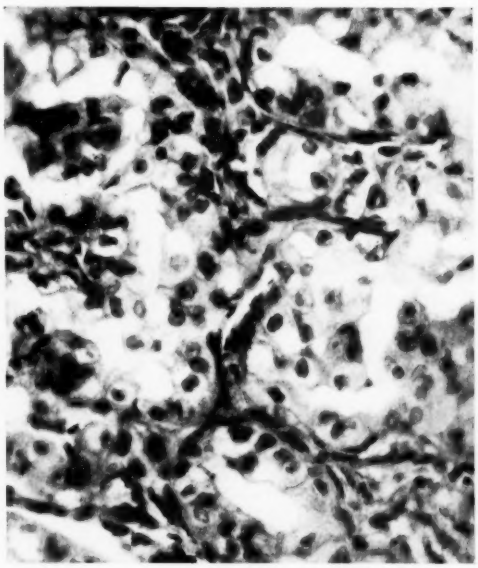

Fig. 6. High power of Figure 4, tubular epithelium.

ample expansion with normal resonance and breath sounds. An occasional râle is heard over the left chest. There is no abnormal mediastinal dullness. The heart is not enlarged to percussion, the sounds are of good quality, and no murmurs are detected. Extremities are negative, the knee jerks equal and active, and no areas of disturbed sensation are found. No tenderness is elicited in the lumbar vertebræ. There is a mass which can be palpated in the left upper abdomen, in the left flank, and in the left costovertebral angle. It moves with respiration but cannot be moved by bimanual palpation. It comes well below the costal margin in the mid-axillary line. The surface contour is practically regular. The mass is not tender nor is there any abdominal spasm or rigidity. It gives the impression of being a kidney tumor. There are no other abdominal masses. Blood pressure: systolic, 140; diastolic, 90. Urinalysis shows reaction, acid; specific gravity, 1.020; albumin, very faint trace; sugar, none; microscopic, red blood cells. Blood: red blood cells, 4,140,000; hæmoglobin, 75 per cent; white blood cells, 6,200; polymorphonuclears, 64 per cent. Blood Wassermann, negative. Blood chemistry: Urea nitrogen, 18.0; creatinin, 0.20; uric acid, 4.45; sugar, 91.0; and salt, 460.0, all expressed as milligrams per hundred cubic centimeters of blood. Roentgenograms of chest, spine, and pelvis show no evidence of metastases.

Operation. On April 17, 1928, a left nephrectomy (E. F. K.) was performed. Curved incision was made from a point just within the tip of the last left rib to a point in front of the anterior superior spine of the left ilium. The kidney was found to be very large and because of this the application of clamps to the vascular pedicle was extremely difficult. The removal of the kidney after section of the pedicle was likewise very difficult because of the large size of the organ.

Pathological examination. Gross: The specimen consists of a large globular mass 16 centimeters in diameter and weighing 980 grams (Fig. 1). It comprises a kidney with tumor attached. The renal pelvis and part of the ureter are present. The kidney is thinned and has become a shell around the tumor mass. The tumor is surrounded by a fibrous capsule sharply separating it from the kidney tissue. The tumor is gray, friable, and has a necrotic center into which there has been hæmorrhage. The pelvic lymph nodes of the kidney are enlarged. Microscopic: The kidney tissue away from the tumor shows mild chronic changes. The interstitial tissue contains a few round cells. The glomeruli are congested and some of them are fibrosed. Some of the tubules contain casts and nearly all contain some exudate. Near the tumor the kidney tissue shows much compression. Sections of the tumor show a diversity of elements which are for the most part neoplastic and embryonal. Epithelial and connective tissue elements predominate, but there are a few places where smooth muscle may be distinguished.

The connective tissue elements have the appearance of rapidly-growing sarcoma (Figs. 2 and 3). The cells are spindle shaped and contain large, hyperchromatic nuclei with mitotic figures. The cells vary in size and tumor giant cells are frequent. The cells are arranged in delicate strands or broad sheets. Some sections are made up entirely of these cells while in others they act as a supporting stroma for the epithelial cells.

The epithelium is present in a variety of forms (Figs. 4, 5, 6, and 7). In some areas the cells are oval and arranged in solid cords. Here the cells have scant cytoplasm and large nuclei among which mitotic figures may be seen. In other places the epithelial cells are arranged more loosely, the cytoplasm is more abundant, and they suggest the appearance and structure of the embryonal carcinoma of the testicle. Elsewhere the cells are tufted in their arrangement as though they were attempting to form renal glomeruli. In still other places the cells are cuboidal and have a distinct tubular arrangement suggesting abortive

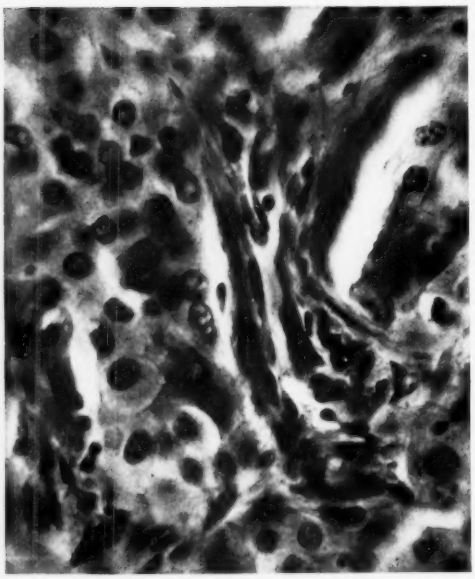

Fig. 7. Oil immersion of Figure 6. Note strands of malignant spindle cells supporting tubules.

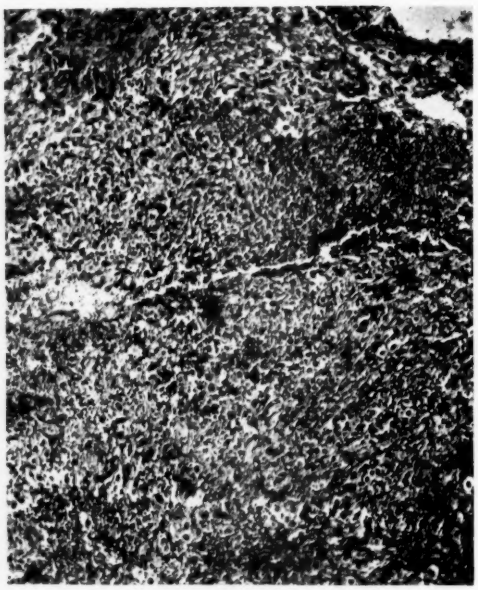

Fig. 8. Recurrence in sinus.

renal tubules. In all instances the cells are distinctly malignant, hyperchromatism is abundant, and mitotic figures are found.

Smooth muscle is found in many of the slides in the form of slender strands and in no place is it abundant. With the hematoxylin-eosin stain it appears to be much more common than the differential stain proves it to be. Some slides are entirely devoid of it but it is found in the central part of the tumor as often as in the region of the renal pelvis. No striated muscle, bone, or cartilage was found.

Some sections show a preponderance of epithelial elements and others show a preponderance of sarcomatous tissue but it does not appear that the periphery of the tumor contains the sarcomatous element to the exclusion of the epithelium. In one slide in which the capsule of the tumor is present, i.e., at the extreme periphery, the epithelium has a marked preponderance.

The blood vessels are small and well formed. Near the center of the tumor there is much blood pigment in the tissue.

Diagnosis. Embryonal adenomyosarcoma of the kidney.

Course. For the first 48 hours after operation the course was stormy, necessitating the use of stimulants hypodermatically and saline intravenously. After this, recovery was without untoward symptoms except for more pain in the wound region than is usual, due to a superficial infection. He was free from symptoms and had a normal temperature after the fourteenth postoperative day. He was discharged to his home on the twenty-second day after operation with the wound clean and healed except for a small sinus.

During the following 5 weeks the patient gained 12 pounds in weight, the wound closed completely, and his strength returned so that he again took up his old occupation. From then on, however, he began to fail and 3 months after operation a moderate hæmorrhage occurred from the wound which had reopened. He was readmitted to the hospital on July 28, 1928.

Examination of the wound at this time showed it to be healed except for an area 2.5 centimeters by 1.2 centimeters surrounding the opening of a sinus. This area presented a reddened, friable, and readily-bleeding surface which had the appearance of a skin recurrence. A hard, non-tender mass, which moved slightly with respiration, was present in the left upper quadrant of the abdomen extending from above the costal margin to about the level of the umbilicus. Biopsy was taken from the sinus.

Pathological report of biopsy. Gross: The specimen consists of three pieces of tissue resembling granulation tissue. They are roughly 1 centimeter square and 2 millimeters in thickness. Attached to one is a bit of skin.

Microscopical examination. One section shows a layer of normal skin and a small amount of subcutaneous fibrous tissue. Below this is a solid mass of atypical spindle cells with pronounced variation in size and shape, arrangement and staining capacity. Most of the nuclei are densely chromatic and some are many times as large as others. There are many mononucleated and multinucleated giant cells. Many mitotic figures are seen. There are no attempts at alveolar formation and the epithelial elements, prominent in the original tumor, are lacking. The other elements correspond closely (Fig. 8). There is considerable infiltration of the tissue with round cells and polymorphonuclear leucocytes.

Diagnosis. Embryonal adenomyosarcoma of the kidney recurrent in sinus tract.

Subsequent course. From this time on the condition of the patient went steadily down hill with an increase in the size of the mass in the left upper quadrant. His death occurred 24 weeks after the operation and about 32 weeks after the onset of the first symptoms. Permission for

au opsy was not obtained. At the time of his death there was no evidence of the tumor at any site other than the place of its recurrence.

Our thanks are expressed to Dr. James Ewing for examining the slides and confirming our diagnosis; and to Dr. Charles D. Lucas for his painstaking care in the preparation of the specimen and help with the photographs.

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CORRESPONDENCE

PANHYSTERECTOMY TECHNIQUE

To the Editor: Under the above caption in your July, 1929, issue. Dr. J. F. Baldwin, of Columbus, Ohio, has been kind enough to criticize specifically certain steps in my simplified technique for total removal of the uterus by the abdominal route published a few months ago.[1]

Inasmuch as these criticisms may lead to confusion in the minds of some regarding the merits of my operation, I feel that it is incumbent upon me to answer them.

Objection is made, first, to that step of the operation described as Number 12 and illustrated in Figure 6, which deals with the separation of the rectum from the vagina on the ground that normally the rectum is not attached to the upper portion of the vagina and, therefore, that this step is unnecessary.

My reply to this objection is that I have nowhere asserted that such an attachment normally exists. The established practice of draining abscesses in the cul-de-sac of Douglas by perforating the posterior vaginal fornix and the pelvic peritoneum would alone suffice to nullify such an assertion even had I fallen into the error of making it. But, unfortunately, normal anatomical relationships in the pelvis do not always obtain where panhysterectomy is required. Indeed, one frequently encounters pelvic pathology which has brought about not only an intimate attachment of the rectum to the upper vagina but to the lower cervix as well which must be intelligently dealt with prior to the completion of the panhysterectomy. I submit, therefore, that the step of my operation intended to meet exactly this situation should be included in the technique and is properly described and pictured.

The second objection is based upon an interpretation of Figure 9 from which the conclusion is drawn that by my operation "the vagina is necessarily shortened by nearly or quite an inch" and that "the shortening of the vagina must necessarily result in more or less dyspareunia and thus prove a fatal objection."

[1] Surg., Gynec. & Obst. 1929, xlviii, 248.

It is unfortunately true that the illustration in question might give this impression and I regret that this inaccuracy in the drawing escaped my notice prior to its reproduction. However Step 16 describes this part of the operation in detail and there is not a syllable in it that would justify such a conclusion. It is self-evident that there would be no point in shortening the vagina by deliberately cutting away one inch of its upper portion. As a matter of fact, the detachment is made as closely as possible to the cervix and consequently there is no appreciable shortening and no subsequent dyspareunia.

Third, Dr. Baldwin quite naturally prefers his own method of dealing with the uterosacral ligaments to mine. I greatly prefer my method to his for reasons clearly set forth in Step 17 of my article. Both methods having been published, the profession is in a position to make its own choice, and so the matter rests.

To my own testimony I am now in a position to add that of a widely scattered group of pelvic surgeons who have been kind enough to inform me of their adoption of my technique because they have found that it both simplifies the operation and reduces the hitherto troublesome hæmorrhage to a negligible factor. Thus far I have had no postoperative infections in my series of cases.

EDWARD H. RICHARDSON.

Baltimore,
Md.

HYDATID CYSTS OF THE LIVER.—
A CORRECTION

To the Editor: Through an oversight I neglected to state the fact that the syringe mentioned in my article on hydatid cysts of the liver, which appeared in the February, 1929, issue of SURGERY, GYNECOLOGY AND OBSTETRICS, is a modification of the syringe known in France as the Dévé syringe.

HAROLD DEW.

Melbourne,
Australia

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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NOVEMBER, 1929

SURGICAL PATHOLOGY AND MICROSCOPIC CANCER

MANY years ago William H. Welch said to me that when the microscope was first discovered, practically everyone who looked through this new instrument of precision and described minutely what he saw and published it, was a discoverer. This day has long passed. The new thing today is not the microscope, but the fresh tissue removed in the operating room from the living patient.

William Mayo has often made the statement that the pathology, or rather the cellular pathology, so wonderfully developed by Virchow and the early general and surgical pathologists was dead pathology. Their well known published records describe and illustrate the stage of disease after death of the patient. These older pathologists had very little difficulty in distinguishing either by the gross appearance or from the study of the microscopic section, the benign from the malignant. When I studied in the great pathological department of Vienna in 1893, practically the only difficult microscopic diagnoses were the distinction between inflammatory processes and sarcoma.

The enlightened individual who sees the value of periodic examinations and submits to a critical study the moment he or she is warned, will, when operated upon, present a pathological picture of a type that very few of the older pathologists or the younger pathologist trained in the older pathology, would recognize.

In 1912, seventeen years ago, I took a collection of sections of border-line breast tumors, largely types of chronic cystic mastitis and papillomatous cysts, to a few cities and asked a number of pathologists and surgical pathologists to study these sections with the microscope and write down their diagnosis, and whether they advised the removal of the tumor, of the breast, or the complete operation for cancer. The first was the largest group and met through the kindness and courtesy of Professor MacCallum in his laboratory in Columbia University. There was no uniform agreement. The diagnosis of malignancy varied from 20 to 60 per cent in the various localities. I have every evidence today to believe that in every single instance the breast lesion was benign. We mixed with these border-line sections a few examples of scirrhus carcinoma and benign fibro-adenoma and intracanalicular myxoma. There was no disagreement whatever regarding these.

Since 1920 the relative number of border-line lesions in the breast and bone, cervix and body of the uterus, oral cavity and skin, stomach, colon and rectum, and now from the lung, has rapidly increased. Today there are not enough pathologists with the proper train-

ing to meet the demands for frozen-section diagnosis in the hospitals of this country. Either there must be provision made for training these special surgical pathologists, or we must speed up research for a differential stain. Cancer is becoming a microscopic disease. Less and less can we depend on the clinical and gross pathological picture. Not only is it becoming a microscopic disease, but the number of early cases in which it is difficult or impossible to distinguish the cancer cell from the abnormal cell that is not yet cancer, has multiplied rapidly.

In the Surgical Pathological Laboratory of the Johns Hopkins University I am trying to meet both demands. In the new Garvan Research Laboratory we have organized for research for a differential stain. In the older laboratory we are offering a continuous course of microscopic study throughout the 4 years.

The diagnosis of pathological lesions through the microscope is largely a matter of memory, and this requires special training, continuous operation. One must work like great artists. There must be no letup in the practice. Every student should examine at least a dozen sections daily. Frank Mather, professor of art at Princeton, recently told me that he thought he had to memorize at least ten thousand photographs in order to learn how to distinguish the original masterpiece from a good but spurious copy. We have figured out that a surgical pathologist should memorize at least a thousand sections. There is, first, the routine, and then the rare microscopic pictures, and for each routine or rare pathological lesion there are one or more atypical ones. For example, there is the routine typical giant cell tumor of bone and perhaps ten atypical smaller groups.

Dr. Broders from the Mayo Clinic recently visited me, and I asked him to look at a number of sections difficult to diagnose which were waiting for my inspection, and I noticed he hesitated and took a much longer time than when I worked with him in his own clinic. I asked him what was the matter. He answered: "I am out of practice. I have not seen a section for two weeks." The medical student who wishes to become proficient in the diagnosis of fresh tissue in the operating room must prepare by beginning the study of routine sections in the first year, even before he has had general pathology. He has had his histological training and this should continue throughout the four years. By the third year he should begin with frozen sections and some time during the fourth year should be spent with the pathological team in the operating room.

I began the teaching of surgical pathology 36 years ago, and in the past 5 years the majority of the time of students in the laboratory was given to the study of microscopic sections. The clinical picture and the gross pathology so essential years ago, are becoming of less and less importance.

The significance of this is that in the diagnosis and treatment of cancer in its earliest stages, there will be a great demand for pathologists trained in microscopic diagnosis. The American College of Surgeons must use its influence with the medical schools and with the staffs of the great hospitals of this country and help them provide for a pathological team in the operating room as well as for an anæsthetic team, in addition to the essential operating team, and now we also need a team for blood transfusion and the treatment of shock. It is often possible to combine pathologist and operator in one individual. This seems economically the best ultimate solution, and it makes for a greater career for the pathologist to be an operator, and makes the operator a far more useful individual if he is a pathologist.

Should a differential stain be discovered, the pathologist may lose his job, but if he is also an operator, he will not.

JOSEPH COLT BLOODGOOD

AN INDICATION FOR EARLY OPERATION IN INTESTINAL OBSTRUCTION

ENTEROSTOMY is commonly performed as an emergency measure for the relief of intestinal obstruction occurring either as a secondary factor in a variety of intra-abdominal, extra-enteric conditions, or as the direct result of a lesion originating in the gut itself. The general opinion as to the merits of the operation is fairly well settled and this discussion is not concerned with them. It has proved, in our experience, a most valuable resource.

The high mortality reported following enterostomy is the inevitable concomitant of its use in already dying patients. It has been natural to delay interference until sufficient time has elapsed for the patient's condition to make operation imperative. This is the crux of the situation, for when we take as our criterion a condition that is no longer only potentially desperate, the sequel of enterostomy is apt to be a death from many factors too long existant before operation even though action of the bowel be re-established. Clearly, then, a new criterion for interference becomes necessary, one by which we can predict that the patient's situation will become desperate before that time actually arrives.

We believe that we have now such a criterion. Oddly enough, it devolved from a study of the methods of temporizing. The most effective non-operative treatment for paralytic ileus at present is the injection of spinal anæsthetic. This is also applicable to many cases of partial obstruction of the mechanical type, such as the recurring and temporary obstructive crises of carcinoma of the colon and of old intraperitoneal inflammatory diseases. In the response to this treatment we have a true indication for or against enterostomy.

If, within 15 minutes after the injection of the spinal anæsthetic, passage of gas and fæces and disappearance of distention be not obtained, enterostomy should be performed immediately, thus taking advantage of the anæsthesia already produced. Longer delay permits progressive depletion of salt and water reserves, interference with circulation of the gut, absorption of toxin from the intestine, and the advancement of those other processes (the nature of which is still controversial) which singly or in combination cause death. After failure of response to spinal anæsthesia, expectant treatment alone, no matter how fortified by attempts to meet the patient's physiological needs, only delays the inevitable.

We have, then, in spinal anæsthesia a therapeutic test which gives the indication that enterostomy will become necessary before the condition of the patient makes it evident.

WILLARD BARTLETT, JR.

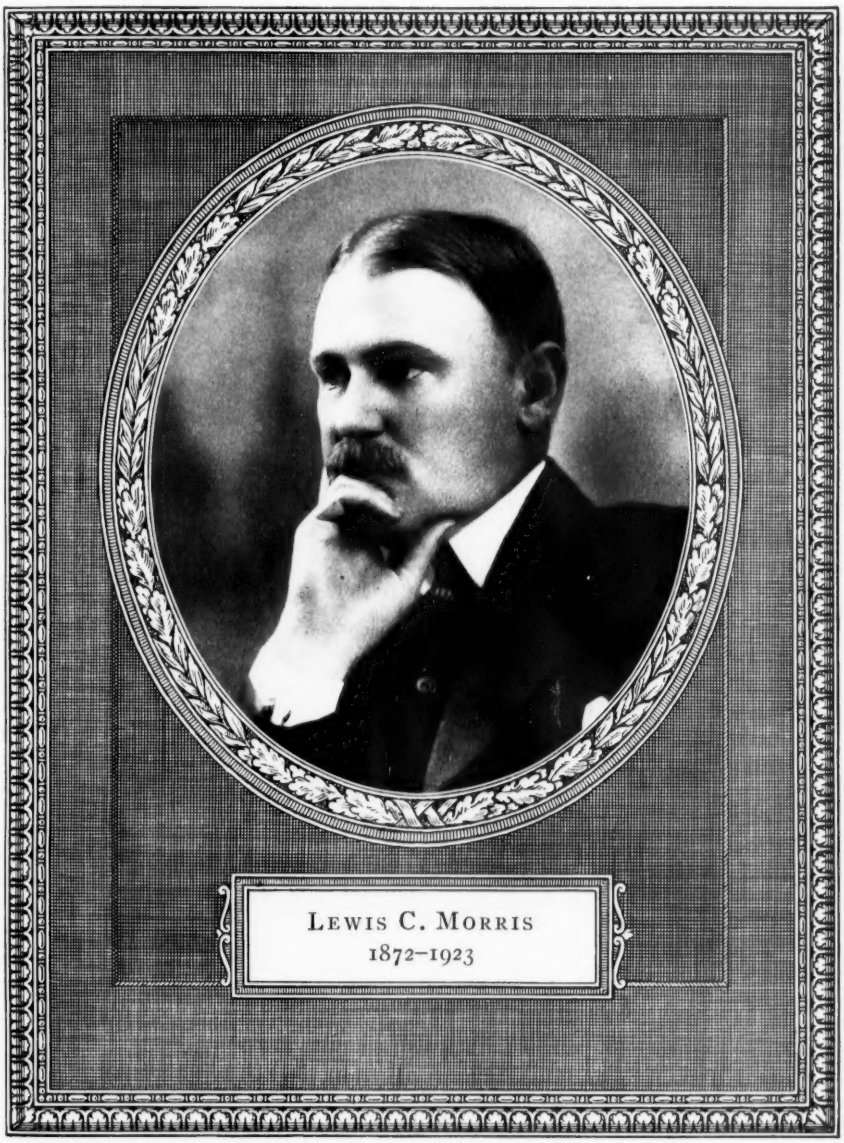
MASTER SURGEONS OF AMERICA

LEWIS COLEMAN MORRIS

LEWIS COLEMAN MORRIS was a student, an educator, a leader in progressive movements in the interests of public health and hospitals, and a master surgeon. Though the span of his life was brief, the correct appraisal of it in service to his fellowman entitles him to first rank among the great surgeons, not only of the South, but also among the eminent surgeons of the generation in which he lived. He was a native of Virginia, the state which has given to the nation so many eminent men in education, in law, in statesmanship, in medicine and surgery. He imbibed the spirit of these great men. Tracing his life as a whole the great fundamental principle that guided it was that of preparation for usefulness.

He was a descendant of one of the most distinguished families of Virginia. He was born at Clazemont, Hanover County, Virginia, January 23, 1872. His grandfather, Richard Morris, of Taylor's Creek, Hanover County, a member of the Virginia Constitutional Convention of 1829–30, was a man recognized as a leader among the greatest men of his time. His parents were Edward Watts and Matilda Coleman Morris. His father was a member of the Virginia Constitutional Convention of 1850–51. His mother, a member of one of the leading families of Virginia, was related by birth to the Minors, the Maurys, and the Dicks. Lewis Coleman Morris, destined for a great career in any vocation, chose that profession in which he believed he could be most useful to his fellowman. While modest and unassuming, he appreciated his heredity, his environment, and his opportunities, and he made the most of them.

His early education was received at McGuire's School in Richmond, Randolph-Macon College, Ashland, Virginia, and later in the University of North Carolina, at Chapel Hill. His medical education was secured at the University of Virginia from which he graduated in medicine in June, 1892. His unusual work as a student was recognized by his Alma Mater in his appointment as demonstrator of anatomy. After one year's successful service in this position, he resigned and practiced a few months at Salisbury, North Carolina, but in the fall of the same year, 1893, he joined his brother, Dr. Edward Morris, in the practice of surgery in Birmingham, where he spent the remaining thirty years of his active and highly successful career as a leader and honored member of the medical profession in



LEWIS C. MORRIS
1872–1923

Alabama. Dr. Edward Morris was one of the most prominent surgeons in Birmingham and one of the most distinguished and learned members of the profession in Alabama. He had a large and lucrative surgical practice. Soon after these brothers began their professional work together they established the Morris Sanatorium which was successfully conducted until 1907. The death of Dr. Edward Morris left Dr. Lewis Coleman Morris a large surgical practice. Dr. Lewis Morris, though greatly grieved because of the untimely death of his older and devoted brother, entered with determination, energy, and enthusiasm into the professional work which had formerly been done by the two. His success was remarkable from the beginning.

At the outbreak of the Spanish-American War in 1898, although busily engaged in his professional duties, he volunteered for service and entered the Army as surgeon of the First Alabama Regiment and served with distinction until peace was declared. On being honorably discharged from the service he resumed his professional duties in Birmingham and was asked by Dr. W. E. B. Davis to become his associate in the chair of gynecology and abdominal surgery in the Birmingham Medical College—a notable honor and distinction, for Dr. Davis was a pioneer in this branch of surgery, and a man of national and international reputation. This association continued until Dr. Davis' death when Lewis Coleman Morris succeeded him as professor of gynecology and abdominal surgery.

There are many things that mark Dr. Morris as an unusual man. It was evident from the beginning of his career in Birmingham that he had used well every possible opportunity in the preparation of himself for the study of medicine; that he had applied himself diligently as a student of medicine while in college; and that he had availed himself of, and used well, every possible opportunity for continuing his education after graduation. One could not be associated with him without being impressed with his appreciation of the great men in the profession who had done such notable work in pioneering the way for all that is possible in the prevention and cure of disease. It was his desire to do his full part in advancing the science and art of medicine and surgery, and to maintain the high ideals of service and honor which had characterized the great and the noble in the profession who had contributed so much to its progress and elevation. To better qualify himself to do this he did post-graduate work at Johns Hopkins, visited the great surgical clinics of this country, London, Paris, Vienna, and other European cities. He perfected his own technique by operative work on cadavers and increased his experience in abdominal surgery on living anæsthetized dogs. He was as thorough in asepsis and antisepsis, as careful in handling tissue and in the use of sutures and instruments in operating on dogs as he was in operating on the human. His purpose was not merely to do the operation correctly but to get the dog well. It gave him great delight to show the dogs operated on and to call attention to the fact that they were perfectly well.

There are members of the profession throughout the South and other states who will ever be grateful to Lewis Coleman Morris because they were correctly taught the fundamental principles of gynecology and abdominal surgery and were inspired by his lofty ideals of preparation and service to higher attainments and greater usefulness. He was ever striving for greater facilities and better methods for teaching these important subjects. As a teacher he was clear, accurate, forceful, and interesting. His didactic lectures were thoroughly prepared and well delivered. In discussing a subject he emphasized the essentials and left out nothing that was important. He was kind, courteous, patient, and considerate, but most exacting in requiring each student to have a thorough knowledge of the subjects taught by him. The importance of the study of the individual patient by the surgeon as well as the internist was always emphasized. He taught that each patient should be thoroughly examined, and that in doing this the student should use his own eyes, his own fingers, his own judgment and that he should know as far as possible the complete history of the case and have all possible laboratory aids in reaching a decision as to the diagnosis. He believed and taught that didactic lectures were only helpful, and that the teacher who depended upon them without practical instruction on the cadaver and living tissue was not discharging his duty to those whom he taught. To supplement his lectures and the study of patients in the hospital and clinic, he required the students in groups to do operative work on cadavers, and also under his own direction or the direction of his associate to do operative work in groups on dogs. He required students of his classes to examine and study cases in the free dispensary. He taught that in case of a surgical mortality it was of the greatest importance that an autopsy be held.

Dr. Morris was intensely interested in medical education. He regarded the hospital—preferably the general charity hospital—as being a vital part of the teaching facilities of a medical college. His wisdom in association with other members of the faculty of the Birmingham Medical College in 1901 in forming an alliance between the college and the Hillman Hospital, which is the general charity hospital of Jefferson County, located in Birmingham, whereby the members of the faculty of the said institution appointed the staff of the said hospital to serve during each session, stamps him and his associates as being far-sighted and correct in their plans for the proper use of the hospital in the practical teaching of medicine and surgery. At that time it was not possible to secure the continuous service for the entire year. The permanent contract with the hospital, however, gave to the medical school indispensable teaching facilities for the scholastic year. Dr. Morris and his associates maintained that it was in the interest of the hospital and the medical school that the teaching faculty constitute the staff of the hospital as a continuous staff, and this was finally achieved when the medical school in 1912 became a part of the University of Alabama.

The insight and forethought of Dr. Morris with reference to medical education was also demonstrated in the position which he took with the faculty of the medical school in 1906, when he urged that the entire property of the school, rights, and privileges including the contract with the Hillman Hospital, be given and conveyed to the trustees of the University of Alabama. He stated then clearly to the faculty that medical education should be conducted by the state universities or by highly endowed institutions. Most of the members of the faculty agreed with him, but at that time it was not possible to get all of them to agree to give the property, as aforesaid, to the University. In 1912 largely through the efforts and influence of Dr. Morris, the interests of those members of the faculty who would not consent to giving the institution to the University were purchased and the institution—all its property, equipment, rights, and privileges—was given to the University of Alabama. At this time Dr. Morris was elected dean in addition to his duties as professor of gynecology and abdominal surgery. Thus, all medical education in Alabama was discontinued except under the auspices and as a part of the University of Alabama.

Those who stand for the highest ideals in medical education throughout the country can appreciate the great service rendered by Dr. Morris, his associates, and the University authorities in placing medical education in Alabama on a unified foundation, directed and conducted by the University of Alabama. This achievement stamps Dr. Morris for all time as being a great leader in medical educational progress. He believed that medical education should be so standardized as to protect the public from men who, through ignorance or lack of professional knowledge and training, are not qualified to practice medicine, but that state boards of examiners should not penalize reputable and capable physicians who have already demonstrated before a similar board having equal requirements and standards that they are competent to practice by requiring them to take an examination. "In all justice, equity and fairness," said Dr. Morris, "I cannot see why a man who has passed a satisfactory examination before a State Board having equal requirements with ours, whose character and standing is certified to by his State Board, should not be accepted by us, whether that State reciprocates with us or not." The foregoing statement was made by Dr. Morris in 1912 when he was president of the Medical Association of Alabama.

The prevention of disease was to Dr. Morris a subject of fundamental importance to the very existence, civilization, well-being, and happiness of mankind. During his administration as president of the Alabama State Medical Association notable work was done in Alabama by the Rockefeller Hookworm Commission. He called attention to the fact that pellagra then constituted a serious menace to the people and urged an intensive study of the disease. He recommended the establishment of a State Hospital for the treatment of tuberculosis, and during his administration such a hospital was built at Wetumpka, Alabama. He urged

the importance of the prevention of rabies and recommended the adoption of ordinances for the control of dogs in communities in which the disease prevailed. He believed that the State Laboratory maintained at public expense should be so adequate and efficient that no hamlet in the confines of the State would be so remote and no patient so poor that he could not without price or cost derive the benefits of modern laboratory findings. During his administration the State Department of Health inaugurated a system throughout the State by which diphtheria antitoxin could be secured at public expense for indigent patients. He recommended a system for legally requiring vital and mortuary reports from the members of the profession which he believed would cause Alabama to be placed in the registration area within 6 months. Thus we see a great and eminently successful surgeon advocating far reaching progressive public health measures of paramount importance in safeguarding the lives and making possible the happiness of the people as a whole.

At the beginning of his career in Birmingham he became a member of the Jefferson County Medical Society and of the Alabama State Medical Association. He was a member of the Birmingham Surgical Society, a Fellow of the American Medical Association, the American Association of Obstetricians and Gynecologists, the Southern Surgical Association, and the American College of Surgeons. He had been president of the Jefferson County Medical Society and the Birmingham Surgical Society. In 1910 he was vice-president of the Southern Surgical Association. In 1912 he was president of the Medical Association of Alabama. He took part in all the active work of these societies and read papers which were timely and of great value and importance. Next to his family he derived his greatest pleasure, happiness, and enthusiasm for his work from these meetings and the association with his professional friends.

At the time of his death he was consulting surgeon in Birmingham of the Southern Railroad. He had been for years, and at the time of his death was, a member of the staff of St. Vincent's Hospital, Hillman Hospital, and The Children's Hospital as gynecologist and abdominal surgeon. He was a member of the medical advisory board of Hillman Hospital and chairman of the board of The Children's Hospital. The Morris Memorial Hall, endowed by friends and former patients in the beautiful new building of the latter institution, stands as a lasting monument to his life of service in Birmingham. Indeed, his life work is embodied and enshrined also in the development and enlarged continuous usefulness of St. Vincent's Hospital and the Hillman Hospital. He was cordially welcomed in his professional work to all the hospitals in Birmingham. His unfailing courtesy, hearty cordiality, and marked appreciation of services rendered in behalf of patients, endeared him to nurses and the entire hospital personnel. His diagnostic ability, sound judgment, and great surgical skill were recognized by his colleagues who frequently called him in consultation.

Dr. Morris rarely went to public social functions but was happy in the social affairs of homes. He entertained in his own home in a unique manner. He gave house-parties at his old home in Virginia and enjoyed entertaining his friends at his fishing camp on the river. He made his guests feel that they were at home and that he sincerely enjoyed having them. It gave him great pleasure when a number of his medical and surgical friends joined him on a hunting trip. He loved bird dogs—one of the most famous in the South, Lewis Morris, was named for him. It gave him great pleasure to take his sons to baseball and football games, and while he enjoyed the games, he enjoyed still more the association with his children. He played golf for exercise and recreation.

Lewis Morris is and will continue to be missed by his friends and colleagues. The wholesome influence of his life cannot be eradicated and will continue to do good throughout eternity. He was happy in the thought that he had been permitted to take part in the work of life. He realized that the illness with which he was suffering would possibly cause his passing suddenly at any time. Although conscious of this he did not alter in any way his mode of work and living. He was active in church work being a member of the Episcopal Church; he believed firmly in the Christian religion and had no fear of death. It was not necessary for him to proclaim his religion. Those who knew him recognized that his views on all subjects were sane and well-founded. His life testified that he was a true disciple of the One who said, "Suffer little children to come unto me and forbid them not." These vital principles were instilled within him by his parents from earliest childhood, and constituted the solid foundation of his life. In the most urgent and perplexing surgical emergency and in business, professional and social relations most provocative of anger, he was master of himself and the occasion. In a surgical emergency he did the correct and wise thing; in no relation did he show or give expression to anger or say aught against any one. His high attainments, lofty character, and great success made him free from thoughts of envy and jealousy, and caused him to take great delight in the success of his colleagues and friends.

Dr. Morris was first married to Miss Susie Martin, a lovely and cultured member of a wealthy and influential pioneer family of Jefferson County, Alabama, who lived for less than a year and was survived by one daughter who died in infancy. In 1907 he married Miss Bessie Jemison, a daughter of Mr. Robert Jemison, a great industrial leader in Alabama. Her family is one of the most prominent, influential, and wealthy in the State, and were early settlers and developers of Tuscaloosa and Birmingham. His wife, a beautiful, attractive, cultured, and worthy companion, aided him greatly in his surgical progress and usefulness. He is survived by his wife and three children—Edward Watts Morris, Lewis Coleman Morris, and Miss Elizabeth Morris—who cherish and revere his memory.

Truly the life of Lewis Coleman Morris, master surgeon, devoted husband, father, and true friend, is worthy of emulation not only by all who aspire to be master surgeons but also by all mankind. After having completed a busy day's work, he died suddenly on March 23, 1923, at the dinner table—in the arms of his close friend and secretary, Mr. W. J. Webb—surrounded by his devoted children, his wife being out of the city. No greater eulogy could be expressed on the life and work of any great soul than the words of the one who knew him best: "I feel that he fulfilled perfectly every relation of life."

E. P. HOGAN

RVFFI EPHESII MEDI

ci de appellationibus partium corporis humani, Libri III,

Eiusdem tractatus De vesicæ ac renum affectibus.

Eiusdem fragmentum libri De medicamentis purgantibus.

Horum libroru primus à Junio Paulo Crasso Latinitate donatus est, reliqui autem duo ab alio.

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

ALFRED BROWN, M.D., F.A.C.S., OMAHA, NEBRASKA

RUFUS OF EPHESUS

THE Christian Era opened on a world largely demoralized so far as science, including surgery, was concerned. Greece was past history in leadership in culture and learning. Rome, the ruler of the world, had passed into a state of licentiousness, bred of easily acquired wealth and power and as always under such conditions learning fell into the background. Cornelius Celsus, a learned Roman, wrote on medicine and surgery but being of the upper class felt it beneath his dignity to practice and what he wrote was largely theoretical.

The great men of surgery must therefore be sought in other countries, subjugated to Rome, it is true, but far enough away so that the Roman yoke did not press heavily enough to prevent the exercise of some initiative and ambition. The most logical country in which such accomplishment is to be sought is the great near East where the three great cities, Ephesus, Smyrna, and Pergamum, vied with each other to become the first city of Asia. All of these cities were subject to Rome but they fulfilled the condition of distance noted above.

Rufus, always called "of Ephesus," though nothing is known of his life, probably came from that city. When he was born is not known and his exact time cannot be determined accurately. It is generally assumed to be somewhere about the middle of the first century A.D. He is referred to by Galen—hence he must have preceded him and was probably dead by Galen's time for the latter made it a rule not to mention his contemporaries. Rufus traveled some, probably went to Rome, and surely went to Egypt for he mentions cases which he saw there. Among others he describes a disease called "Ophis," the symptoms of which correspond with what is now known as "Guinea Worm" disease and one of the earliest parasitic diseases described. Rufus says: "This Ophis, thick as a piece of catgut, twists and turns in the flesh like a reptile, especially in the thighs and legs but also in other parts of the body. I have seen, in Egypt, an Arab affected with this disease: when the patient wished to bend over he suffered pain, then he was taken with fever, a swelling like an abscess formed until finally the 'Ophis' rupturing the skin made its exit in pus and putrefaction."

The writings of Rufus that we now have are fairly complete and the method by which they have been collected is very interesting, for many of them have been obtained by quotations from other later writers and not directly from his manuscripts. Junius Paulus Crassus translated the Anatomy "Concerning the names of parts of the human body" from the Greek into Latin and published it in the *Medicae Artis Principes* of Stephanus in 1567. The fragments of the "Diseases of the Bladder and Kidneys" and "Purgative Medicines" in the same work are by another translator whose name is not given. Rufus was, however, not only one of the first of the physicians of the Christian Era but also one of the greatest and served as a master for the later physicians to follow. The editions of his works, however, consisted only of fragments, here and there: some in manuscript and some in the quotations already referred to, until, in 1851, Daremberg began his search to get them all together. He did not live to finish the task, but the work was not allowed to drop and Ruelle, with Daremberg's notes as a basis continued the task to completion. The result was published in Paris in 1879 under the title *Œuvres de Rufus d'Ephèse* and is a veritable mine of information.

Rufus was anatomist, physiologist, philosopher, physician, and surgeon, and withal a man of great common sense. As an anatomist he dissected the ape and described the optic chiasm. He noted that the nerves proceeded from the brain and divided them into two classes—the motor and the sensory. He discovered that the pulse had its origin in the heart and that the arteries as well as the veins contained blood. In surgery he was an active practitioner, for he states that he operated for the stone and describes his method. He also describes an operation he performed for fractured skull. But above all these, where Rufus shines is in his article entitled "Concerning the interrogation of patients." In this he stresses the necessity of knowing all there is to know about the patient and his habits and to bear this in mind in the treatment of the case. As an example he says: "It is necessary to ask the patient if he has or has not a good appetite, if it is or is not altered, and to inform oneself of the usual condition of each thing, for it is not less important for the physician to be versed in the knowledge of the habits than in the nature of each; indeed, habitual food is less apt to harm than unaccustomed food which otherwise might appear to be of better quality; it is necessary also to consider the manner in which food is customarily taken, its quantity, and its method of preparation." Rufus calls attention to many things which are of value today.

REVIEWS OF NEW BOOKS

THE *Injection Treatment of Internal Hemorrhoids*[1] by Pruitt is a very clear and concise treatise on the non-surgical treatment of hæmorrhoids. The first chapters are devoted to the anatomy and to the pathology which offers the field of this treatment. The etiological factors which lead up to this condition are usually occupation, age, sex, and, last but not least, heredity. The pathological change that we find in the hæmorrhoidal veins is in a manner similar to that occurring in varicose veins in other parts of the body. This is clearly shown and illustrated by Quénu's classical description of the pathological changes in the hæmorrhoidal veins.

Before taking up the treatment, the author gives a detailed description of the different forms of hæmorrhoids that may be encountered, their complications, their clinical symptoms, such as bleeding, prolapsing, itching, mental depression, and pain. It is clearly pointed out that this latter symptom of pain occurs only when infection or strangulation has occurred. The method of injecting hæmorrhoids was first used by Edwards in England nearly a half century ago. He kept it a secret and sold it to individuals, some of them non-medical men, who traveled about the country and called themselves "Pile Curers." Since this method was so viciously exploited at its very beginning it is no wonder that it was frowned upon by the medical profession. From various sources we learn that it was first used in this country about 1875 by Mitchell, of Clinton, Illinois. He used a solution of carbolic acid of about 33 per cent. At the present time all old prejudices have been cast aside and forgotten and this method of treatment has been given due credit. Although it has not wholly replaced the operative treatment, it is frequently used by reputable proctologists. The technique of operation, the after-treatment, as well as the advantages and disadvantages are fully discussed. The final result of both methods depends largely upon the skill, experience, and judgment of the operator.

C. J. DE BERE.

THE book entitled *Studies on Malaria*[2] is in brief an autobiography of the discoverer of the source of malaria. It has been an inspiration to read this little book. It is the direct statement of his life work by a man utterly devoted to science. All those who struggle in the dark with the unseen enemies of health should read it and take comfort from it.

In these days, the research worker is supported by extensive endowment funds and is encouraged by the repeated successes of modern science. The contrast that Ross and other early pioneers offer is most forceful. Ross worked alone in his little regimental hospitals at various stations in India from 1889 on, and finally, in 1897, discovered the parasites in an anopheles mosquito which he had fed on a malaria patient. The rest of his life was devoted to study of the problem but chiefly to a struggle for practical malaria prevention by mosquito extermination. Gorgas' work at Havana and Panama was a direct development of this.

The book has many interesting contacts. It contains a long letter to Lord Lister, several accounts of the British Empire builder, Sir William MacGregor, a trip to America when he met Gorgas, and a delightful incident with Osler, and because of these, forms a valuable addition to the history of the growth of modern medicine. In addition, there is throughout a discussion of the malaria problem. It is difficult for us to appreciate the importance of this disease of the tropics where it "causes probably one or two million deaths every year besides an immense amount of persistent sickness." The book is concluded by a chronological list which contains 108 references on malaria.

From every point of view this book is worth reading—as a stirring personal story, as medical history, as an example of scientific method, and as a source of information on a great health problem.

PAUL STARR.

THE Oxford monographs on diagnosis and treatment are moderate in size and the subjects are simply but adequately covered by recognized authorities. The first volume on *The Diagnosis and Treatment of Disorders of Metabolism*[3] is a general discussion of disorders of metabolism including the measurement and variations in normal metabolism, disorders of intermediary metabolism, disturbances of water balance with special reference to anhydremia, œdema and diabetes insipidus, acidosis and alkalosis, gout, obesity, and diabetes mellitus. I am impressed with the practical and explicit way in which Dr. McLester has elucidated these subjects. Modern surgical management requires that one have a thorough understanding of these fundamental facts of metabolism.

The discussion is characterized by details of technique so that this book becomes a clinical handbook which might well be supplied to internes and be studied by all interested in the immediate management of patients. The basic metabolic condition of patients is certainly of pre-eminent importance in pre-operative and postoperative care. This work gives specific directions for the control of anhydremia, œdema, and acidosis and alkalosis. It will be found valuable by the surgeon as well as the internist.

PAUL STARR.

[1] INJECTION TREATMENT OF INTERNAL HEMORRHOIDS. By Marion C. Pruitt, M.D., L.R.C.P.S. (Edin.), F.A.C.S. St. Louis: The C. V. Mosby Company, 1929.

[2] STUDIES ON MALARIA. By Sir Ronald Ross, K.C.B., K.C.M.G., F.R.S., F.R.C.S. London: John Murray, 1929.

[3] OXFORD MONOGRAPHS ON DIAGNOSIS AND TREATMENT. Edited by Henry A. Christian, M.D., Sc.D., LL.D. Vol. i—The Diagnosis and Treatment of Disorders of Metabolism. By James S. McLester, M.D. New York: Oxford University Press, 1928.

THIS book, *Chirurgie des Voies Biliares; Spiro-Cholécystostomie*,[1] is a paper-bound monograph of 120 pages. After 17 pages of text, mostly general material about gall-bladder disease, there follows the section on operative technique consisting almost entirely of pictures, many in color. It concludes with a summary of 50 cases. These case histories are too short to be of any possible value, and no follow-up statistics are given.

The operative section, the *raison d'etre* of the monograph, describes three methods of dealing with infected or stone containing gall bladders. The reviewer has not a doubt but that every sane surgeon would condemn all three methods as bad in every feature. The first method consists of ligating the cystic duct, winding the end of the ligature around the gall bladder several times, and then sewing the gall bladder firmly to the anterior abdominal wall. The second is to skin the intact mucosa out of the gall bladder and sew up its outer coats leaving them in. The third is to split it in two and then to currette the mucosa of the part left on the liver and to sew up the remainder into a new tube. E. A.

SEMB'S book[2] on cancer of the breast was sent for publication February, 1928. It is the most complete and best recent monograph on the subject. There are 472 pages. It is the most comprehensive review of the literature since the publication of Deaver and McFarland, on the breast.

There are certain omissions, however. He has failed to find my most comprehensive study[3] on the pathology of chronic cystic mastitis of the female breast with special consideration of the blue-domed cyst, although he gives reference to two later articles of mine in 1922 and 1924. It is unfortunate, because the conclusions in my article in 1922 strongly favored that chronic cystic mastitis *is not a precancerous lesion*. When cancer occurs in this benign lesion of the breast, it is an incidence and not a consequence, and I have just sent for publication further studies—four articles—confirming this view of 1921.

The author, Carl Semb, comes to the conclusion, after the study of his cases, that chronic cystic mastitis is a precancerous lesion and that it is safer to remove the breast, even when there is no microscopic evidence of cancer. To repeat, my conclusions are the exact reverse. This former first assistant in the Pathologic Laboratory of Professor Francis Harbitz has based his studies on 144 cases which represent the entire material of fibro-adenomatosis mammæ received during a period of two and one-half years from a great number of surgeons and clinics. He therefore is dependent upon other clinics and surgeons for the clinical history and the follow-up. I have been studying this disease for almost 40 years. My first publication was in 1906, when I fell into the same error with Reclus and Schimmelbusch in concluding that at least the diffuse type of chronic cystic mastitis, in which large, blue-domed cysts are conspicuous by their absence, and in which the predominant microscopic picture is diffuse papillary cystadenoma and irregular adenoma are precancerous lesions. Semb calls diffuse, irregular adenoma *fibro-adenomatosis simplex* (his Fig. 3), and papillary cystadenoma *fibro-adenomatosis cystica*. He presents 23 photomicrographs, while I presented 40. This is evidence that he has not presented the entire microscopic possibilities. It is my opinion that two and one-half years with an experience of 144 cases is not sufficient to establish the relation of this disease to cancer. If one will glance over the literature as so well reviewed by Dr. Semb and with which I have been familiar since 1906, one will find that the authors who have had the longest experience in years and in the larger number of cases, express the opinion that chronic cystic mastitis has no relation to cancer. Billroth and Velpeau belong to this group, while others base their conclusions on a few cases and over short periods of time. Sir Ashley Cooper, in 1888, observed one cancer in 12 examples of cysts of the breast.

The chief element of error is the misinterpretation of the microscopic appearance of certain stages of this parenchymatous disease. I now have at least 300 examples of this lesion of the breast which have been diagnosed cancer in some clinics and by one or more pathologists. The axillary glands have not been involved, and there has been no recurrence, and the patients have not died of cancer.

We must look upon this monograph of Carl Semb as a very important contribution to the literature from every standpoint and a fine example to the younger men in the various clinics throughout this world. In every clinic there is the material and the available literature. The things needed most are enthusiastic young men and women who are willing to do the work. The cause of chronic cystic mastitis is still unknown. I trust that those who read this book will also read my contribution in the original and thus, if possible, save their patients whose breasts are the seat of this benign disease from any operation at all, or from the loss of the breast after the excision of a zone and frozen-section study. In my clinic, of the 65 per cent of women who have lesions of the breast for which operation is not indicated, the clinical picture suggests chronic cystic mastitis in more than one-half of the cases. They are grouped clinically in multiple tumors in one or both breasts, unilateral or bilateral lumpy breast, or "shotty" breast, and those with worm-like masses beneath the nipple. The most common single tumor of the breast in the group of one month's duration is the blue-domed cyst, or a non-encapsulated area of chronic cystic mastitis. In both of these groups too many breasts are sacrificed, because of the difficulty

[1] CHIRURGIE DES VOIES BILIARES; SPIRO-CHOLÉCYSTOSTOMIE. By C. Sobre-Casas. Preface by Pr. J. L. Faure. Paris: Masson Et Cie, 1928.

[2] PATHOLOGICO-ANATOMICAL AND CLINICAL INVESTIGATIONS OF FIBRO-ADENOMATOSIS CYSTICA MAMMAE, and its Relation to Other Pathological Conditions in the Mamma, Especially Cancer. By Carl Semb. Oslo. Nationaltrykkeriet, 1928.

[3] Arch. Surg., 1921, iii. p. 445.

of interpreting the microscopic pictures from cancer, or because the operator or pathologist is of the opinion that chronic cystic mastitis is a precancerous lesion, and that it is therefore safer to remove the breast. JOSEPH COLT BLOODGOOD.

A SUMMARY of the six lectures delivered by Crile at the University of Washington in 1927 is found in *Problems in Surgery*.[1] They are on totally unrelated subjects and have all been published before in other form. The first paper is on the management of acute infections and contains much sane advice to the young surgeon. The use of antiseptics is not encouraged, but stress is laid on the physiological mechanism by which the body normally combats infection. Rest is especially emphasized, meaning absolute rest—the putting of the mind, as well as the body of the patient, at the greatest possible ease. Heat, fluids, a blood transfusion, if necessary, and morphine are the cardinal points. Especially valuable is the advice not to disturb unnecessarily the patient by giving useless stimulants, vaccines, antiseptics, and other fads. A more or less general discussion of carcinoma is given with clinical examples and the diagnosis and operative technique.

The most interesting features of the book are the papers on the operations on the bad risk patient and on the mechanism of hyperthyroidism. Both of these contain physiological discussions as to just what constitutes the bad risk case and what fundamental metabolic disturbances are involved in the various types. The inter-relation of the adrenal and thyroid, the effect of loss of heat to the brain, and the effect of various toxæmias on the cells of the brain in numerous conditions are discussed. In a series of graphs the effect of prolonged ether anæsthesia on the temperature of the brain and the parenchyma of the liver is shown. The fall is so great that it must be clear to anyone that the activity of the cells is markedly impaired and that ether anæsthesia is therefore contra-indicated in such cases. Crile's use of the diathermy to counteract this effect is, however, to say the least, open to discussion.

The whole work makes very interesting reading. It is packed full of practical suggestions based upon the enormous experience of the author and shows throughout his great enthusiasm for scientific investigation. EDMUND ANDREWS.

IN preparing the volume on *Surgical Pathology*[2] the authors have attempted "to put forward such an account of the pathological side of surgery as may help readers in their clinical work." They have endeavored "to trace the pathology of each surgical disease from its inception." These purposes have been satisfactorily accomplished. The first 162 pages deal with general, the remainder of the 904 pages with special, surgical pathology. The section on general surgical pathology is brief, but the authors have the rare faculty of compactness of expression, so that the subjects are adequately discussed for the group of readers for whom the book is primarily intended, namely, practicing surgeons and students who have had the regular course in pathology. The subject of inflammation is discussed in 7 pages, but these furnish an excellent review of the fundamental changes that occur in inflamed tissues. The subjects of special surgical pathology are not all considered with equal completeness nor with equal facility. Perhaps the best part of this portion of the book is that which deals with the pathology of bones and joints. This was, perhaps, to be expected inasmuch as the junior author is an orthopedic surgeon. In considering diseases which are not specifically surgical the "reader is referred to works on medicine and pathology."

The typography is clear and no glaring typographical errors have been encountered. On page 782 is the statement that adrenal rests "are found under the cortex of the kidneys." They are actually found immediately under the capsule. Pathologists who consider Hodgkin's disease as a lymphogranuloma would hardly approve of classing it as a lymphadenoma. The illustrations are well selected and, on the whole, fulfill their purpose well. In many instances the microscopic picture accompanies the gross appearance of the pathological condition under consideration. Illustrations of bacteria are inserted as inch-square insets. Reproductions of roentgenograms are used very effectively especially in the chapters on the pathology of bones and joints. Of special value are the diagrams which show the routes of spread of infection in different organs and parts of the body and the lymph drainage of the breast. The index is admirable and comprises 39 pages, thus making reference easy. Much unnecessary repetition is avoided by means of an excellent system of cross references which are found in the text. There is no bibliography. J. P. S.

PEMBERTON'S work[3] consists of 340 pages devoted to a study of the various phases of the problem of arthritis. It represents for the most part the personal experiences of the author with a very large number of cases of arthritis of various types treated by him during and since the War. He makes a concise presentation of his own experimental and clinical observations and at the same time makes free use of the published reports of other workers in this field. The work accomplishes the purpose for which it is intended, in that it connects Pemberton's own observations, it correlates them with the work of other students, and it presents to the general practitioner in a practical way such information as will aid him in the treatment of patients suffering with arthritis. W. H. H.

[1] PROBLEMS IN SURGERY; UNIVERSITY OF WASHINGTON GRADUATE MEDICAL LECTURES, 1927. By George W. Crile, M.D. Philadelphia and London: W. B. Saunders Company, 1928.

[2] SURGICAL PATHOLOGY. By Cecil P. G. Wakeley, F.R.C.S. (Eng.), F.R.S. (Edin.), and St. J. D. Buxton, M.B., B.S. (Lond.), F.R.C.S. (Eng.). New York: William Wood and Company, 1929.

[3] ARTHRITIS AND RHEUMATOID CONDITIONS; THEIR NATURE AND TREATMENT. By Ralph Pemberton, M.S., M.D. Philadelphia: Lea & Febiger, 1929.

ADEQUATE pre-operative and postoperative care of surgical patients has helped to avoid many a fatality and has rehabilitated many post surgical risks. And yet an almost helpless attitude has characterized the management of patients afflicted with postoperative thrombosis and embolism, one of the most feared complications in surgery. In a recent monograph[1] Professor Ducuing has given a complete description of the anatomy, pathology, and physiology of phlebitis, thrombosis, and embolism. The correlation of these fundamental principles with detailed clinical observations is the outstanding feature of the book. The frequency of such complications—225 cases of phlebitis and 300 cases of embolism in 3,000 operations—must make the reader feel that either he has frequently overlooked slight manifestations of phlebitis and embolism or that the author's increased attention to the subject has influenced the interpretation of minor symptoms. The study of the case histories, however, justifies the author's percentages. The statistical study of 3,000 personally observed cases is far more important than any other collective material; it enabled him to detect early signs of phlebitis; he has thereby materially reduced graver complications. An attempt has also been made to diagnose the location of venous obstruction, by the appearance of small areas of œdema, by faint cyanosis particularly after exposure to cold, and by the absence of the pilomotor reflexes.

Some of the author's experimental work is incorporated in this book. He seems particularly interested in the supposed venous spasm following thrombosis and brings proofs of this contention. Also, the effect of leeches on the production of thrombosis has been studied. Ducuing's attitude toward the use of leeches in the prophylaxis and treatment of postoperative phlebitis is very skeptical. There has been a renewed interest in this form of treatment in many continental clinics. The author's clinical observations, carefully controlled, do not warrant their use.

There are many valuable suggestions for the prophylaxis and treatment of these conditions; but most important of all is the early recognition. A systematic search for early symptoms may help to avoid serious complications. Pre-operative vaccination is given an important rôle in prophylaxis.

The diagrams and photomicrographs are very lucid; a more concise handling of the subject matter would avoid unnecessary repetitions. The bibliography is of unusually wide and polyglot scope. As a whole, this is a most original and inspiring contribution; it deserves wide recognition. GÉZA DE TAKATS.

AS the title *Clinical Electrocardiograms; Their Interpretation and Significance*[2] implies, this book is made up almost entirely of illustrative electrocardiograms. The author has not attempted to discuss the subject of electrocardiography in general. In his preface, indeed, he disclaims any attempt to discuss the technique or theory of electrocardiography or controversial questions. The text accompanying the electrocardiograms is brief and devoted almost entirely to elaboration of the legends which accompany the various figures. If there is any fault to be found with the book, it would be in connection with the scanty discussion of the principles of electrocardiography. It appears to the reviewer that the value of the book might be considerably increased if the text were more complete. As it is, the man with limited experience of the subject will find many valuable electrocardiograms including illustrations of all the varieties commonly met with in clinical work. The author has drawn these from an exceptionally large collection and has a background of a wide experience in the clinical application of electrocardiography. These numerous electrocardiograms, backed by this experience, serve to make the book useful to any student of electrocardiography and particularly to those who may happen to be working more or less alone with a subject which is comparatively unfamiliar to them.

The clinical aspects of electrocardiography have indeed been presented completely in the graphic manner designed by the author. Some sections, such as those on ventricular tachycardia and the chapter on individual wave changes, are especially interesting and valuable. JAMES G. CARR.

AN ambitious work of 1,100 pages in 2 volumes on *Surgical Diagnosis*[3] by A. J. Walton is well printed and unusually carefully bound to withstand hard use as a student's textbook or a desk manual for the practitioner. The contributors are with one exception British surgeons, and all are men known to be authorities in the fields on which they write. Not only general surgery but all the surgical specialties are included.

In the introduction the editor deplores the present tendency to lean too heavily on the laboratory for diagnoses and throughout the work the stress is laid on careful clinical work with the special diagnostic methods to be used only as confirmation of conclusions already tentatively reached from the clinical examination. While the quality of the material naturally varies with so many authors the standard is uniformly very high and there is a strong tendency to simplify the discussions and reduce them to the clearest and least complicated terms. Principles rather than details are emphasized throughout, and as a result one is surprised to find what an enormous amount of subject matter has been compressed into a small space.

While space does not permit a detailed discussion of each contribution, a few are so outstanding as to

[1] PHLÉBITES THROMBOSES ET EMBOLIES POST-OPERATOIRES. By J. Ducuing. Paris: Masson Et Cie, 1929.

[2] MAYO CLINIC MONOGRAPHS. CLINICAL ELECTROCARDIOGRAMS; THEIR INTERPRETATION AND SIGNIFICANCE. By Frederick A. Willius, B.S., M.D., M.S. Philadelphia and London: W. B. Saunders Company, 1929.

[3] A TEXT-BOOK OF SURGICAL DIAGNOSIS. Edited by A. J. Walton, M.S., F.R.C.S., B.Sc., M.B. Vols. i and ii. New York: William Wood and Company, 1928.

deserve special notice. Walton's chapter on the pituitary body is an admirable condensation of our confused knowledge of this difficult subject. Not only the clinical syndromes but the physiology of the gland is made to appear remarkably easy to master. The section on rectal diseases by Lockhart-Mummery is also unusually good. On the whole, the newer methods of diagnosis such as gall-bladder visualization and ventriculography are well evaluated.

In a work of such magnitude a few errors are bound to creep in; such as the statement on page 870 that a closed loop of colon causes more toxæmia than one in the small gut. Also, the omission of the features of alkalosis in intestinal obstruction is surprising. Again, the entire matter of visceroptosis to which a full chapter is given would be flatly denied *in toto* by most surgeons today.

Aside from these points and the fact that the illustrations are for the most part very bad, one cannot help but feel that this is a valuable addition to surgical literature, as it fills a real need and brings the subject of surgical diagnosis up to date.

EDMUND ANDREWS.

THE present volume of the *Gynecological and Obstetrical Monographs*[1] represents the first supplement since the completion of the series in 1925. There has been nothing outstanding in the literature in the last 4 or 5 years. Progress, however, has been made along certain lines, as for example, in prenatal care, while eclampsia and its treatment are still serious problems.

Sterility, according to Child, still ranks high as a social problem and not only requires the treatment of wife and husband but the application of biological studies as well.

The chapter on menstruation and its disorders has been ably supplemented by Novak. The author has changed his views somewhat since the publication of his original edition, especially as regards the casting off of the menstrual decidua as shown by careful histological preparations of human decidua at various stages during the cycle.

Rubin, in his chapter on transuterine insufflation, pleads for more accurate and clear-cut indications and great care in technique. He regards the procedure as safe in good hands.

The diagnosis of early pregnancy is still a problem; the Abderhalden test has been completely discarded. Other metabolic tests based on urinary excretion of glucose after administration of phlorizin have been tried but as yet these tests are not pathognomonic of early pregnancy. The value of X-ray as a diagnostic aid is increasing after recognizability of the fetus (at about 4 months) and may be used until term.

The treatment of eclampsia is still an enigma; the Stroganoff treatment or extreme conservatism is still being employed by some while others are using cæsarean section or other surgical procedures. The Lazard intravenous magnesium sulphate treatment has its advocates and has given fairly satisfactory results in the conservative management of eclampsia.

Ehrenfest has revised his original monograph on birth injuries and has added an excellent bibliography. He emphasizes the immediate recognition of symptoms and lesions which may have a direct bearing on early treatment. Interest in birth lesions has extended beyond the domain of the obstetrician and pediatrician. The pathologist, neurologist, surgeon, laryngologist, and ophthalmologist all have taken interest in the subject. Many well known pathological conditions and clinical entities, previously designated as congenital, are now definitely known to be intranatal injuries. Surgery has proved very promising in many cases.

Cæsarean section seems to be on the increase and this state of affairs is deplored by many writers. The classical operation has had little added to it in the last 7 years. Newell recommends the low incision, and A. B. Davis the high incision, in classical cæsarean section. The low cervical operation is gradually increasing in popularity and likewise the indications for it. Its advantages, in doubtful or infected cases, are now definitely admitted. With improved technique and local anæsthesia in the hands of a good operator, the operation is admitted to be far superior to the classical section. In the group of infected cases the Porro operation is still employed and more recently within the last 2 or 3 years the Portes operation seems to be quite promising. The chapter on cæsarean section is well illustrated.

Many problems in pelvic inflammatory disease are still unsolved. Protein therapy and diathermy in properly selected cases seem to be of value.

Little advance has been made in puerperal sepsis; serum is of no avail; surgery is questionable. The best active treatment should consist of removal of sutures and drainage of abscesses.

Pleas are made for early recognition of malignant tumors of the uterus. Carcinoma campaigns and propaganda have helped in having patients report early. Radium plus surgery are still the greatest hope. The lead treatment of cancer (Blair Bell) plus X-ray, if necessary, seem to produce some good results. This treatment is still in the experimental stage. Neither one or all methods are entirely satisfactory to date.

Sampson's theory of endometriosis while still highly interesting, has not yet been finally accepted. Culbertson, in his chapter on surgery of the female pelvis, gives an excellent and clear cut outline of postoperative management. The treatment of peritonitis, hæmorrhage, and shock is systematically organized.

E. L. CORNELL.

NOT merely a theoretical contribution to the improvement of museums in general and medical museums in particular, but a description of practical

[1] CUMULATIVE SUPPLEMENT AND COMPOSITE INDEX. GYNECOLOGICAL AND OBSTETRICAL MONOGRAPHS. New York and London: D. Appleton and Company, 1928.

achievement based upon theory and vision is Daukes'[1] new book on the medical museum. The functions of a medical museum are discussed, and the details of the new system of visual teaching on which the ideal medical museum is based are described.

Everyone interested in museums, whether in regard to construction, development, control, or use, should read and study this book. Having done so there will be a natural desire to see its methods developed in actual practice.

THIS volume on *Diseases of the Liver, Gall-Bladder and Bile-Ducts*[2] is widely known through two previous editions. The text is divided into four parts: one, diseases of the liver; two, diseases of the biliary tract; three, diseases of the gall bladder; and four, diseases of the bile ducts. There is a short section on radiological diagnosis and methods of bilirubin estimation.

Three-quarters of the book is devoted to diseases of the liver. Chapters on anatomy, physiology, and abnormalities appear first in the book and others on diseases of the hepatic artery, portal veins, infarcts, hepatitis, abscess, cirrhosis, syphilis, tuberculosis, cysts, tumors, and jaundice follow. The material presented in this section is as complete a piece of work, from a pathologic and clinical standpoint, as can be found in the literature. In the concise, direct method of description and excellent English of the authors, one is frequently reminded of Osler's Single Volume Medicine.

The section on gall bladder and bile ducts is presented in much the same fashion as that on liver. This is not a surgical text, and treatment is given but slight attention. If there is any criticism of this section, it is that no attention is devoted to the diagnosis of early and mild cholecystitis. Viewed as a whole, however, this volume is considered one of the outstanding contributions to the literature of liver and bile ducts.

J. R. BUCHBINDER.

STEINDLER is a man peculiarly well qualified to write on *Diseases and Deformities of the Spine and Thorax*.[3] His knowledge of English, French, German, and Italian orthopedic literature is unusually intimate and complete. The subject is of importance to every orthopedic surgeon. The presentation of the material is excellent as is the sequence of the subject matter treated.

Emphasis has been placed upon the proper subjects. There is much originality in the book which reflects the author's intensive study and research work on the conditions discussed.

His choice of illustrations is excellent, and the execution of them is on the whole very satisfactory. Numerous roentgenograms, line drawings, and anatomical sketches should be of value to the reader.

The subject of congenital deformities of the spine and thorax has been treated extensively, and the chapter on spondylolisthesis has been very well done. In the chapter on scoliosis, the author has referred to practically every good article that has appeared in the literature. In addition, he offers the results of his own extensive research and intensive study. He includes the Galeazzi method of treatment of scoliosis.

Fractures and dislocations are given a good-sized chapter. The chapter on low back pain is worthy of the attention of every orthopedist, gynecologist, and industrial surgeon. Tuberculosis and osteomyelitis of the spine are discussed, as are syphilis and arthritis of the spine. Tumors of the spine are included in one chapter and a synopsis of the anatomy of the spine in another.

The author has been fortunate in having the advice and help of Dr. H. J. Prentiss concerning all anatomical questions.

The work of the publisher is well done. The bibliography is comprehensive and well organized. This book should be of great value to the orthopedist, the pediatrician, the neurologist, and the physical therapist. In it the practitioner will find an encyclopedia of information concerning the subjects treated.

PHILIP LEWIN.

WARTHIN'S small volume on *Old Age*[4] will be, to the middle aged, a stumbling block, to the youthful, foolishness. The latter will be unable to comprehend how the phenomena of the major involution herein described can be applied to him. The former will be more or less stunned by the realistic description of the aging process. He will, therefore, stumble but he need not fall, and the remainder of his journey may be made easier and more satisfying for having read this book.

The underlying idea is expressed by the author in the following paragraph quoted from pages 76 and 77:

"We are defending the thesis that *senescence* is a *normal involutionary process*, and its underlying laws and phenomena are essentially identical with those of the minor involutions of the growth period of the organism. The main differences between the minor and the major involutions are those of degree, purpose, and the organ or tissue involved. The minor involutions affect single specialized structures that are more or less temporary in function, and as soon as this temporary function is fulfilled, are unnecessary to the general economy of the organism and are disposed of without affecting the more permanent vital functions. The major involution, senescence, affects all of the vital organs and functions, not for any purpose of further growth and evolution, but for the purpose of getting rid of the organism, itself, as

[1] THE MEDICAL MUSEUM; Modern Developments, Organisation and Technical Methods Based on a New System of Visual Teaching. By S. H. Daukes, O.B.E., M.D., D.P.H., D.T.M. & H. London: The Wellcome Foundation, Ltd., 1929.

[2] DISEASES OF THE LIVER, GALL-BLADDER AND BILE-DUCTS. By Sir Humphrey Rolleston, Bart., K.C.B., and John William McNee, D.S.O., F.R.C.P. 3d ed. London: Macmillan and Company, Ltd., 1929.

[3] DISEASES AND DEFORMITIES OF THE SPINE AND THORAX. By Arthur Steindler, M.D., F.A.C.S. St. Louis: The C. V. Mosby Company, 1929.

[4] OLD AGE, THE MAJOR INVOLUTION; the Physiology and Pathology of the Aging Process. By Aldred Scott Warthin, Ph.D., M.D., LL.D. New York: Paul B. Hoeber, Inc., 1929.

a whole. This can mean but one thing: the individual human machine has fulfilled its function, and, now useless, stands in the way of the progressive evolution of the species. In other words, the minor involutions take place for the good of the single individual, the major involution for the good of the species. Inasmuch as the reproductive function is the chief one of the individual life and from the biologic point of view the one logical reason for the ascent and maturity of the animal energy machine, it is but logical to conclude that when the carrier of the immortal germ plasm has arrived at maturity and continued at the stage sufficiently long to have secured its survival in his progeny, he, himself, is then in the way of evolution. Biologically useless he has become and he disappears from the scene by the gradual fading-away process of senescence."

This volume as a whole possesses real literary merit. Parts of it may be too technical for the layman to understand fully. Its value for the general public may be questioned because few men possess the intellectual and moral stamina to read it without becoming greatly depressed. However, for certain types of minds, it will prove helpful because with all its pessimism, in the commonly accepted sense of that term, it does show the only way to meet the inevitable with equanimity. J. P. S.

IN a small and practical volume on the diagnosis and treatment of gastric and intestinal diseases[1] Cheney emphasizes the clinical rather than the laboratory means of diagnosis. For instance, the point of view in regard to the X-ray diagnosis of these conditions is conservative, a point of view much needed now when there is a tendency to believe anything read into the X-ray films. Thus: "By X-ray examination theoretically it is easy to distinguish. . .the presence of pathology in this organ (the gall-bladder). As a matter of fact, however, the expected X-ray evidence is not always definite enough one way or the other to make the diagnosis certain, and it becomes of value only when considered in connection with other facts." These other facts, as emphasized throughout the work, are the symptoms educed by intelligent history taking. The description of these syndromes is excellent.

The author's point of view as regards surgery is well represented by one of his rules in regard to intestinal obstruction, i.e., "call a surgeon in consultation early so that he may share in the responsibility for the decision as to when medical efforts shall cease and surgical shall be employed, and so that, if the ultimate outcome is unfavorable, the charge cannot be made that the surgeon was called too late." The problem of diagnosis is always presented from both sides, i.e., the negative or dubious as well as the positive or certain. This treatise, therefore, becomes helpful where help is most needed, that is, in the obscure abdominal conditions. The character of the book is well presented in the following sentence: "Face to face with the problem at the bedside, familiar with all the theoretical points that should distinguish one condition from the other, the physician finds occasionally that the conclusion reached is erroneous, as is shown ultimately by operation or by autopsy. Every effort should be made by every method of examination to reach an accurate deduction as to which form of disease is present, but a spirit of humility is much more fitting than one of pride in this uncertain field of diagnosis."

PAUL STARR.

THE book entitled *The Mobilization of Ankylosed Joints by Arthroplasty*[2] is an interesting and readable monograph. The technique of the authors differs in many particulars from that of other operators, especially in the character of the incisions recommended and in the careful preservation of the capsule surrounding the joint. Murphy and many others advise the removal of the thickened and usually adherent capsule.

The use of a double layer of free fascial flap is a valuable suggestion, and the method of attaching it is ingenious. In the chapter on arthroplasty of the hip, the diagram shows the fascial flap fastened with a pursestring around the large and well modeled head of the femur, while the X-ray pictures, with one exception, show that the head has been entirely removed so as to leave only a conical stump of the neck, around which no pursestring ligature could possibly hold. It is, however, a fact that nearly all of the illustrations of hip arthroplasties so far published show the same wide removal of the head, and since most of these cases were of satisfactory results, it is probable that the bold resection of the head is productive of greater mobility and scarcely less stability than is provided by a more perfect anatomic modeling.

Concerning arthroplasty of the knee, the authors propose the use of a straight anterior incision in the skin, with an inverted "V" incision through the quadriceps tendon and the joint coverings. It is doubtless as good as any of those used by other operators and has the merit of simplicity. The illustrations of Putti's technique are apparently reproduced from one of his earlier articles and differ from his present method in many important particulars.

The descriptions of the authors' operations are not sufficiently clear to enable an inexperienced surgeon to follow them with ease and certainty. The illustrations, both diagrammatic pictures and X-ray reproductions, have not been well chosen and do not depict adequately the excellent technique and the great experience of the authors.

The bibliography shows careful and extensive research. EDWIN W. RYERSON.

[1] OXFORD MONOGRAPHS ON DIAGNOSIS AND TREATMENT. Edited by Henry A. Christian, M.D., Sc.D., LL.D. Vol. II: THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE STOMACH AND INTESTINES. By William Fitch Cheney, B.L., M.D. New York: Oxford University Press, 1928.

[2] THE MOBILIZATION OF ANKYLOSED JOINTS BY ARTHROPLASTY. By W. Russell MacAusland, M.D., and Andrew R. MacAusland, M.D. Philadelphia: Lea & Febiger, 1929.

THE late Sir John O'Conor was for many years Senior Medical Officer of the British Hospital at Buenos Aires. In the present volume on *Reflections and Operations*[1] are collected O'Conor's many contributions to the surgical literature representing observations and conclusions based on forty years of active surgical practice. The originality and forcefulness of this volume will bring pleasure, interest, and stimulation to every surgeon. O'Conor refers to the statement that "a good surgeon is not necessarily a good technician" as "claptrap" and "academic blather" and substantiates his right to criticize by listing 1,200 operations all of which were done in 12 minutes or less. The practical nature of the author's comments is evidenced by the following: "It seems somewhat of a farce to set papers for examination containing questions—for example, the dissection and difficulties attending exposure of the pituitary gland, carotid body, or semilunar ganglion—to candidates who do not know how to hold a knife or handle a needle, and if entrusted with the application of a ligature to a pedicle, even money, make such a violent tug on the second lenot as to smash up the whole procedure." Despite the great amount of sound common sense in the volume, it is scarcely to be recommended for students. O'Conor places great stress on the value of alcohol in health and disease and even makes the statements that "Teetotalism is a frequent cause of arteriosclerosis" and "universal total abstention would tend in a comparatively short cycle of time to depopulate the earth." His recommendation of a pint of champagne by rectum in the treatment of shock would be a very expensive treatment in this country. Almost the entire field of surgery is covered with the eyes of an experienced worker and active observer.

FREDERICK CHRISTOPHER.

IN a volume on *Surgical Diagnosis*[2] Donhauser has essayed the task of covering the entire field of surgical diagnosis. He begins with history taking. Chapters on general surgery, dealing with infections, tumors, and kindred subjects follow. The remainder of the text is devoted to regional diagnosis, urology and gynecology included.

The text is written in the form commonly used in teaching undergraduate students and is clear and concise. Its brevity, however, necessarily limits its use to that of a reference volume for junior and senior students. J. R. BUCHBINDER.

IN no place except in a clinic such as found in Vienna, where a tremendous mass of material is gathered together for careful and thorough study, could a work such as Lenk's[3] book on *Roentgendiagnostik* be done. The author has collected a tremendous array of lung tumors and subjected these cases to thorough and exhaustive study. As a result, every known tumor of the lung is carefully described. The book is profusely illustrated with X-ray pictures and these pictures are analyzed and discussed in great detail. Wherever necessary, diagrammatic reproductions of the pictures are used to clarify further the author's analysis thereof. Not only are cases of intrathoracic tumor described, and this the reviewer feels is of tremendous importance, but cases are presented whose X-ray pictures simulate those of lung tumors, and in these cases the differential diagnosis is carefully discussed. The reviewer knows of no other work in which the roentgen diagnosis of intrathoracic tumors is discussed in such an efficient and thorough manner. The excellent index is of great assistance in facilitating the study of Lenk's book. The book, although written in German, ought to be of tremendous interest to every physician who is called to deal with lung tumors and will undoubtedly be a standard reference on the shelf of every roentgenologist.

RALPH B. BETTMAN.

THE book entitled *Die Pathogenetischen Grundlagen der Thyreotoxikosetherapie*[4] is a relatively brief monograph dealing with certain clinical aspects of thyrotoxicosis, namely, classification, pre-operative preparation, and operative technique. For the most part, there is no serious criticism of the author's ideas on thyrotoxicosis, although some exception may be taken to the withholding of iodine, as a preoperative measure, in adenomas, or, as he calls them, secondarily toxic thyroids.

It is interesting to note that during the past 5 years in the services of a general hospital and the surgical division of a University clinic, the author has operated upon but 150 thyroids.

The text is not illustrated, save for a few schematic drawings and several plates representing histopathologic findings. J. R. BUCHBINDER.

LOVE'S *Shorter Surgery*[5] is well named; in less than 300 pages the author skips lightly over the entire field of surgery. The book is intended for the use of students in conjunction with a surgical text. It is written in the so-called "outline form" and is somewhat more voluminous than the usual "quiz compend." J. R. BUCHBINDER.

TO all interested in thyroid disease Hertzler's book[6] should be of great value, since it represents the results of prolonged clinical study. It is by no means a review monograph covering the literature of the subject. It reports the author's own studies

[1] REFLECTIONS AND OPERATIONS. By Sir John O'Conor, K.B.E., M.A., M.D. (Dub. Univ.). With a Foreword by Herbert J. Paterson, C.B.E., M.C., M.D. (Camb.), F.R.C.S. (Eng.). London: Baillière, Tindall and Cox, 1929.

[2] A SURGICAL DIAGNOSIS. By J. Lewi Donhauser, A.B., M.D., F.A.C.S. New York and London: D. Appleton and Company, 1929.

[3] DIE ROENTGENDIAGNOSTIK DER INTRATHORAKALEN TUMOREN UND IHRE DIFFERENTIALDIAGNOSE. By Dr. Robert Lenk. Vienna: Julius Springer, 1929.

[4] DIE PATHOGENETISCHEN GRUNDLAGEN DER THYREOTOXIKOSETHERAPIE. By Johan Holst. Oslo: Jacob Dybwad, 1928.

[5] A SHORTER SURGERY; a Practical Manual for Senior Students. By R. J. McNeill Love. New York: William Wood & Company, 1929.

[6] DISEASES OF THE THYROID GLAND. By Arthur E. Hertzler, M.D. With a Chapter on Hospital Management of Goiter Patients by Victor E. Chesky, M.D. 2d ed. St. Louis: The C. V. Mosby Company, 1929.

and experience and does this in a most refreshing way.

Typical quotations are as follows: "I have always liked the term 'polyglandular disturbances'. It says nothing tangible and stops further discussion." "A soft palpable thyroid is normal in a thin-necked child. Too many operators attack every thyroid they can feel. This is incorrect in patients of any age. Too many itchy fingers seek an excuse to operate rather than a reason for doing so."

As the author says in his preface to this second edition, "The chief interest, I hope, will center on the views of the pathology of the thyroid herein set forth." These views are stated comprehensively and occupy over a third of the total work and are accompanied by many illustrations including microphotographs. Perhaps his most characteristic idea is that contained in this statement in regard to the ordinary classification of goiters into colloid, adenomatous, and exophthalmic. ". . . In following such a classification one must remember that these classes do not represent separate diseases but merely stages, at least for the most part, of one progressive disease. I have many times seen the same individual run the gamut of the whole series; simple colloid, non-toxic adenoma, toxic adenoma, developing finally into a typical Basedow triad, and finally death by heart failure."

I feel sure this work is worthy of careful study and contains much truth. PAUL STARR.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

LA AUTONOMÍA DEL CORAZÓN; CONFERENCIAS PRONUNCIADAS EN EL INSTITUTO DE FISIOLOGÍA DE LA UNIVERSIDAD DE CONCEPCIÓN. By Prof. Dr. Alejandro Lipschütz. Santiago: Revista Atenea, 1929.

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